Computer Age

JANUARY 1980
ISSUE 2
80p

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Editorial

The Made-to-Measure Society

The Anthony Blunt affair has had one good result. The Government dropped its bill to protect official information. Had the bill passed into law it would have completely affected very few of us in our daily lives. But it would have been one stitch further in the straitjacket democracy seems inevitably to be fashioning for itself, and diligently [illegible] of every persuasion all eagerly holding their needles. It sought to take [illegible] measures to protect all governors from people constricting itself [illegible] the [illegible] that make [illegible] will eventually [illegible]

[illegible]

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The Post Office [illegible] criticised by [illegible] about it and they [illegible] that if you [illegible] That is not [illegible] our local post [illegible] sending [illegible] And it [illegible] the Post Office [illegible] is staying [illegible]

Happy New Year dear readers

Meyer N. Solomon

[illegible]

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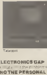

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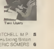

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CLOSING THE MICROELECTRONICS GAP

The author, a Parliamentary Under Secretary of State at the Department of Industry, gives a sane and reasoned outline of Government policy on the micro. Computer Age *is particularly interested in getting the reaction of businesses to the effect the small computer already has had on their staff numbers, morale and efficiency, and is as keenly interested in getting the experience of employees. We hope to publish our conclusions in a future issue.*

> 'It is not now a question of whether a company — whatever its size — can afford to make use of computers, but whether it can afford not to.'

Ten years ago man landed on the moon. Eight years ago the microprocessor was invented. Yet it was only in 1978 that we as a nation woke up to the fact that the microelectronics mattered. Today you have only to look at the small business sector to realise how fundamentally the microelectronic chip, and particularly the microprocessor, is transforming the commercial and industrial life of this country. Integrated circuits and the devices based on them have become so cheap that powerful computing facilities which not long ago would have been rejected out of hand as prohibitively expensive are now within the reach of even the smallest firm — or even, in the case of the personal computer, the interested private individual.

Microcomputers are becoming the norm, not the exception, and an increasing number of software firms are specialising in producing computer programs to meet the needs of the small businessman. Indeed, the launching of [illegible] is itself a recognition of the dynamic expansion of the small computer market. It is not now, therefore, a question of whether a company — whatever its size — can afford to make use of computers, but whether it can afford not to. But I'm not thinking just of data processing when I say that. Any businessman whose products or processes use measurement, calculating, control, display, monitoring, communication or detecting devices should be doing something about using micro electronics to improve the efficiency of his processes or the quality of his products — and now, before it's too late, for his rivals will certainly be taking action in their own organisations.

Things move at such a pace in microelectronics that new developments tend to become obsolescent almost as soon as they hit the market. By the mid-1980s, for example, the chip manufacturers will probably think nothing about cramming 100 times more electronic functions on to their chips than they can today. But for us, or any other industrially developed country, all this has implications which we cannot afford to be head-in-the-sand about.

The functions on which microelectronics is likely to have its greatest effect in terms of innovation and efficiency are control, communications, instrumentation and computing, and these also happ[illegible] be functions which impinge on every aspect of our business and domestic lives. So by the 1980s we won't need to talk any more about the significance of microelectronics: it will be there all around us. The view of Dr Noyce, the inventor of the microprocessor, is explicit: 'It is in the exponential proliferation of products and services dependent on microelectronics that the real microelectronics revolution will be manifested.' So if we in this country are to increase our competitiveness in world markets or to hold our own in our own markets, we shall have to learn how to exploit every benefit of the new technology in developing our industry and commerce — and we shall have to do it more quickly and to better effect than our overseas competitors. This means adopting new attitudes and not repeating mistakes of the past.

Over the last 30 years Governments in every country have tried in some way to encourage higher productivity, better quality and more innovation in the industry. The rapid decrease in our share of world trade in manufactured goods provides dismal evidence of the fact that Britain's efforts in this respect have not been as successful as those of our overseas rivals. But what is particularly worrying now is that there is also evidence to show that, as a nation, we are not yet using microelectronics anywhere near as much as the Americans, Germans and Japanese. If this trend persists, we would quite apart from the other factors involved in our poor industrial performance, be likely to find ourselves more and more ill-equipped technologically to earn a respectable standard of living.

This is a situation which has to be rectified. The Government has therefore decided to proceed with the Microprocessor Application Project (MAP) which the previous administration launched in July 1978.

MAP

MAP has four distinct but complementary facets: awareness, training, feasibility studies, project support.

Awareness

The stir which the BBC TV Horizon programme 'The Chips are Down' created when it was shown in March 1978 emphasised how unaware of the nature and significance of microelectronics people outside the electronics industry were at that time. It was obvious from the start therefore that if MAP was to achieve its aim of ensuring that Britain takes her place as one of the front runners in the new technology, it first had to spread the gospel. Industry and commerce had to be made fully aware of what microelectronics was all about.

We have concentrated on this right throughout 1979, via a nationwide campaign aimed at alerting the country's key decision makers to the facts of microelectronic life. Over 50,000 people from the business world ha[illegible] seminars held [illegible] up and down the country. [illegible] of the campaign [illegible] programme mounted [illegible] television makes from the country's leading [illegible] 3,000 companies [illegible] hope 140 in all were completed [illegible] week period ending in July [illegible] and we are now following up the results. We have also provided [illegible] special MAP exhibition [illegible] and over 12,000 [illegible] have been received in the [illegible] the demand of local [illegible] made available.

We have also set up within the department a MAP Information Centre (Phone 01-212 3411) which [illegible] co-ordination point [illegible] world [illegible] will be made available to the public.

'Before MAP was launched there were only about 2,000 short-course training places available per annum to provide existing engineers with the knowledge of microelectronics they needed.'

The awareness campaign has begun with [illegible] series of events this Autumn.

Training

Ensuring that people know that microelectronics really matters is one thing; supplying the engineers needed to implement the new technology is quite another. The UK has suffered from a critical shortage of electronics engineers for some time. In fact some large companies have complained to us they could be using as many as 1,000 more engineers on microelectronic projects if they could only get them. It was decided therefore to give training high priority under MAP.

Before MAP was launched there were only about 2,000 short-course training places available per annum to provide existing engineers with the knowledge of microelectronics they needed. At the beginning of the year we launched, in collaboration with the National Computing Centre, a crash programme to expand the places available. To date this has added [illegible] new courses in universities, polytechnics, further and higher education institutions, research associations, semiconductor and software organisations and the like. By 1981 we expect to have increased the number of course places to over 25,000.

[illegible] have [illegible] the Open [illegible] Corporation [illegible] files [illegible] on [illegible] as [illegible] sup[illegible]

Feasibility studies

The first two parts of MAP are intended to lay a general foundation on which individual companies can build. The other two get closer to the industrial grass roots.

For example, the support we offer for feasibility studies is intended to help firms — particularly small firms — turn to consultants for expert advice on whether their production processes and/or the products they manufacture could be improved by an injection of new technology. The response has been encouraging. Over 1,000 applications for support have so far been received, and about two thirds of these have already been approved and are being implemented. Assistance of up to £2,000 towards the cost of consultancy is available. Applicants should write to MAPCON, Department of Industry, Warren Spring Laboratory, Stevenage, Hertfordshire.

Project support

Given the rapidity of technological change and the growing competition in microelectronics applications, companies contemplating the development of an entirely new product, or redesigning an existing product or updating their production processes, may hesitate because of the risks involved. Here the offer of Government project support can often tilt the balance in favour of applying microelectronics. We have received over 900 applications from a variety of companies over a range of industrial sectors, and it augurs well for the future that about a third of these are relatively small, with a turnover of up to £2 million. Assistance is available on a selective basis in the form of (a) a grant of up to 25% of qualified costs or (b) a shared cost contract under which the Government will contribute up to 50% of qualifying costs in return for a levy on commercial sales. Application forms are available from The MAP Office, Room 305, Electronic Applications Division, Dean Bradley House, 52 Horseferry Road, London SW1P 2AG.

MAP has made an encouraging start but there is still a long road ahead, and it is just as well to remember that the Government can only point the way. In the end it is only industry — and of course I mean both sides of industry — who can close the technology gap at present existing between us and our competitors and which underlies the diminishing wealth available to our people.

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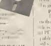

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CULTURAL ENERGY AND THE PERSONAL COMPUTER

This highly acclaimed essay first appeared in the NCC 79 Personal Computing Proceedings book. Readers who would like to contact the author can do so by writing to him at 11[illegible] North 48 Avenue Apt 32 Omaha Nebraska 68132 USA

IBM said it best. On the cover of a brochure describing the history of their computers are printed the lines

> It was to have been the nuclear age
> It became *the computer age* (1)

Although the nuclear age may have fizzled out, the rapid acceptance of the computer in science and engineering, and by the business community, is so much a part of our present culture it is sometimes hard to believe that accomplishments such as the atomic bomb were possible without electronic 'intelligence'.

But while the computer was changing our technology and changing the way we do business, another kind of change was also taking place. For millions of citizens the newspaper and book — outside the environment of formal education — were being replaced by the television receiver. And the effect of electronic communications on our society has been no less great than the effect of the computer on business and technology.

> *'Ideas seem to result from the manipulation of information and data, sometimes by placing one set of data into a new context.'*

Now we have the personal or 'home' computer. It seems to hold great promise but it is not yet clear just how this device will change the lives of average people. Of course, computer hobbyists and enthusiasts can think of plenty of home tasks which *can* be done by the computer. But the average citizen does not necessarily perceive that he needs a computer in order to lead a rich life. In fact, some computer owners are becoming bored with their little machines. After winning a trillion mythical pounds at blackjack, finding real uses for a computer may begin to look like work.

This article will look at the personal computer as a potential device for mass electronic communications. It will show how the method of communicating information within a society greatly affects the intellectual growth of that society and the development of ideas and imagination by individuals within the social group. And it will explain why many proposed and actual sytems of digital communications lack 'power', and describe features of a communications system optimized for the greatest social utility.

The article is not about hardware devices or software techniques. It is about people and information systems. The computer enthusiast whose attention is focused almost solely on the device and very little on the lives of the people computers are supposed to serve, may find this discussion uninteresting. But the issues addressed are important ones, and should be seriously considered by anyone whose interest in large-scale computer

Essay

[illegible] technical [illegible]

It should [illegible] mean by [illegible]. Although the [illegible] data transfer between [illegible] systems, here [illegible] with systems [illegible] utilizes personal [illegible] [illegible] existing digital communication systems such as the teletext systems can also be considered computer mass communications to some extent, although we will see later they may not be utilizing the real power of the microcomputer.

The central focus of this article is an analysis of how the way information is transmitted in a society affects what I will call the "cultural energy" of that society. The term "information" is used here in its broadest sense to include the content of many forms of communication.

But if we are to discuss "cultural energy" we must first look at the laws governing energy systems in general. Although an exhaustive review of thermodynamics is beyond the scope of this article, a superficial review of basic principles may be helpful.

Entropy

In order for energy to be useful for work there must be a flow of stored energy from one potential to another. Everyone knows that electric circuits have positive and negative poles and that current flows between the two potentials. Likewise a jet engine is capable of providing thrust because the high pressure gases inside the engine flow toward the low pressure area just beyond the exhaust outlet. If the air outside a jet engine were at the same pressure and temperature as the gases inside there could be no energy flow and thus no thrust.

In a closed energy system the difference between energy potentials will gradually decrease until a condition of stasis is reached. This means that if the hot gases in a jet engine were not being constantly replaced by the conversion of jet fuel to gas the hot gases seeking the lower potential would gradually cause a cooling down of the interior of the engine while the air just outside the engine would be gradually heated up (to some small degree) until the temperature (and hence pressure) differences were equalized and the energy would cease to flow.

All of the hot molecules would not flow from inside the jet engine to the outside before the system would become static. The measure of the amount of energy unavailable to do work (power the jet plane) is termed the "entropy" of the system. It can be seen that in a closed system the entropy is constantly *increasing*, never decreasing. The energy potentials are always seeking stasis, never a greater differential.

If it is necessary to build up one kind of energy potential (eg the pressure in the combustion chamber of a jet engine) then energy must be taken from a source outside the closed system (such as from jet fuel). But the same [illegible] entropy govern the larger system that includes the additional energy source.

Although energy may be transformed it is never really created or destroyed. The difference between a system with high entropy and low entropy is one of *organization* of the basic energy components. Energy capable of useful work is organized in a specific way. For example we know that in a fresh dry cell an excess of free electrons can be found at a specific pole. If in fact the electrons were randomly distributed within the cell, there would be no difference of potential between the poles and the battery would not be capable of providing useful energy.

Cultural energy

I wish to suggest that these principles also hold true for a domain larger than that of simple physical energy, that there exists in societies a form of *cultural energy*. A component of cultural energy is information and the "work" done by this energy includes the creation of new ideas, inventions and works of art.

Contrary to some people's conception ideas are not spontaneously generated by the mind. If that were the case we would never have to worry about educating people or about losing a potential Mozart to the cultural disadvantages of being raised in a slum environment.

Ideas seem to result from the *manipulation* of information and data, sometimes by placing one set of data into a new context. Many people have noted the relationship of "fooling around" to the creative process. This aspect of creativity is evident [illegible] kinds of [illegible] advertising. [illegible] example, there was in spirit a few [illegible] that advocated the use of a laundry detergent to make a [illegible] washer seem [illegible] tall. The washer shown in the [illegible] did indeed grow to the ten foot height. The juxtaposition of the concept of cleaning power with the height of the washing machine is a form of the same kind of game playing that leads to major scientific breakthroughs.

If the cultural energy that causes new ideas and inventions to come into being does follow the laws of physical energy then it would follow that great periods of cultural development must be associated somehow with the existence of differing energy potentials ("poles") between which the cultural energy "flows".

And this does seem to be the case. The very term "polarized" was used to describe United States society in the late 1960s and in fact that period saw a great burst of creativity and change in the arts and in social structures. As with any closed energy system the laws of entropy ultimately caused a decrease in the difference of energy potential between the various pairs of poles and a randomization of the cultural energy components. Now our society is more stable but less creative/productive. We must wait until energy from another source can be borrowed to "recharge" our creative batteries.

The divergent poles can result from many kinds of forces. Displacing people geographically or socially creates such potentials and the result is creative and cultural development. The philosopher Eric Hoffer has remarked on this phenomenon:

> **Elitest intellectuals hug the conviction that talent and genius are rare exceptions. They are inhospitable to any suggestion that the mass of people are lumpy with unrealized potentialities.**

Tribal Society [illegible] I

> We know of a few instances where the masses were churned and scattered so that their talent content was made visible. The dumping of millions of common people from Europe on this continent was such a churning and scattering. A more sanguinary experiment on the masses was performed by Stalin in Russia. He liquidated the most cultivated segment of the Russian population and then proceeded to extract every conceivable talent and aptitude from the tortured, terrorized Russian masses. It was a cruel, wasteful way; yet no one will maintain that the Russian people are at present less endowed with talent that they were before the Revolution. (2)

But traumatic shiftings of political and social structures are not the only means of creating poles between which cultural energy can flow. *The way in which information is cultivated* seems also to affect the level of useful cultural energy within a society.

The Tribal Society

In a tribal society information between members of the tribe is communicated by speech and personal interaction. If someone in the group seeks to obtain as much information as possible, he must interact with [illegible] the other group members to a high degree. Such interaction is [illegible] [illegible] means that [illegible] heavily tied up with the [illegible] tional [illegible] and that in addition [illegible] tion the individual [illegible] ideas and information [illegible] possesses.

'Elitest intellectuals hug the conviction that talent and genius are rare exceptions'

In such [illegible] the group [illegible] information and the [illegible] by the group [illegible] effect on the information [illegible] individual. Obviously [illegible] information structure [illegible] tion that we saw [illegible] cultural energy and [illegible] develop.

Of course, [illegible] tribal communication is [illegible] and some cultural [illegible] society. But [illegible] growth and technological [illegible] is very slow in primitive tribal [illegible].

Writing helps [illegible] abstract by separating [illegible] information from the [illegible] the communicator and [illegible] the [illegible] action necessary [illegible] is a means of [illegible] the information for ready access by a reader. Obviously writing increases the cultural energy of a society.

Printing carries the process much further. It places huge amounts of information at the disposal of great masses of people. Since we saw that ideas were generated [illegible] from restructuring data, it follows that the greater the quantity of information available to a person the more likely that person is to develop [illegible] ideas.

Print is largely a [illegible] form of communication, however. The reader of a printed document is not expected to reply or interact in any way with the author. And the information is [illegible] that the reader has considerable control over the information received. He can [illegible] skip around and scan the [illegible] for specific information [illegible]. This is quite different from [illegible] obtaining information [illegible] in which the content [illegible] and in which the [illegible] of information flow.

It can easily be [illegible] that the cultural, technological and [illegible] growth of civilized societies [illegible] rapidly after the invention of the printing press.

At first [illegible] electronic [illegible] radio and television [illegible] cultural energy [illegible] information [illegible] people. But this is not the case.

The [illegible] and television [illegible] great [illegible] the [illegible] the [illegible].

[illegible] Marshall McLuhan [illegible] er has virtually no control over the information presented [illegible] the group [illegible] the broadcasting company. Although home videotape storage might seem to give the viewer a bit more control, anyone who has tried to scan a videotape will find the task difficult indeed. The tape can be speeded up, but more than a slight increase in speed results in totally unrecognizable information.

Equating the broadcasting company with the receiving group may appear to be stretching the tribal analogy. However, the great importance placed on audience ratings by broadcasters and their attempts to win over the largest segments of the listening/viewing group point to a larger identification of the group with the broadcaster than might at first be supposed.

Information presented over television is also very personal. TV deals with the con [illegible] highly regarded [illegible] usually have [illegible] filled with so-called [illegible]. But personal [illegible] combined with [illegible] the line for [illegible] is the power [illegible].

Another [illegible] television [illegible] the home [illegible] process [illegible] information [illegible] the [illegible] most [illegible]. And nothing [illegible] cultural and [illegible] than [illegible].

It has been proposed that [illegible] teaching [illegible] duce the [illegible] books are still the prime communications medium of serious education, and to the extent that certain segments of our society rely mostly on radio and television for information and entertainment, we seem to produce larger and larger groups of functional illiterates. And scores on college entrance tests decline.

'Television communication leads to less cultural energy and fewer ideas'

The evidence mounts. Television communication leads to less cultural energy and fewer ideas. Not because television programs are bad, but because the medium lacks the ability to charge our cultural batteries.

Manipulative power

Enter the personal computer. If the computer provides its user with nothing else, it at least gives the user manipulative power. Certain of its manipulative powers are so great that most people regard the computer as a kind of giant calculator, a modern descendant of the abacus, rather than as an information storage and retrieval system like a book.

In its use until recently, the functioning of the computer in society could be compared to the role of books before the invention of the printing press. Only rich or privileged people or organisations had access to its power. Since in our society these privileged organisations tend to be educational/scientific institutions and corporations, the uses of the computer have often been equated with the needs of such organisations.

[illegible] in which personal computers have been promoted to the home [illegible] Most so called home applications [illegible] derived from traditional scientific and commercial applications of the computer Home Checkbook is a kind of general ledger 'Menu Planning comes from institutional food management systems Heating Control is based on industrial process control and Arcade Games are derived from military simulations Whatever the value of these applications in business and science many citizens — including computer owners like myself — get along very well without computerised checkbooks menus and thermostats

If we are going to put a computer in every home then the applications must provide genuine benefits

Information dissemination might just be such an application

Now that reasonably powerful computers can be had at consumer prices we might well consider that one of MITS Tandy or Commodore (for example) has re-invented the printing press Computer signals can be mass transmitted cheaply and electronically like radio and television they can be stored on media having greater storage density than books and the manipulative power of the computer can provide the reader with greater control over the information he receives than can the best books with the most complete indices This is assuming of course that we choose to involve the computer in the process of communication information and not simply use it to reprocess data entered by the user (which is largely the case with personal computers at present)

The power of combining computer manipulative abilities with electronic communications has been well articulated by Carol Anne Ogdin in her book, *Software Design for Microcomputers*

> **Microprocessors have brought us all into the Gutenburg era of computing It is almost as inexpensive to reproduce and distribute a *process* as it is to reproduce and distribute *information* Just as Gutenburg's invention allowed the inexpensive reproduction and distribution of information in the form of printed and bound books the microcomputer will have an astounding impact on society in the next 25 years** (3)

Indeed, the microprocessor is being used for some kinds of mass communications and is proposed for others These real and proposed communications uses seem to fall into one of three categories

1 Digital broadcasting
2 Computer partyline networking
3 Centralized information pooling

In none of these schemes is the computer used to provide an extremely high degree of cultural energy in terms of the societal values discussed earlier We will deal with each scheme separately

Digital broadcasting

A typical present day example of a digital broadcasting system is one of the several commodities market services providing market quotations to large numbers of people through the use of FM subchannel broadcasting (in the U S A)

In such a scheme a central computer feeds market quotations and sometimes other agricultural news to FM radio stations that broadcast the data to the information service customers via the same Subsidiary Communications Authorization (SCA) channels used by Muzak and other special music information services

The customer has a microprocessor based terminal that displays the information on a TV monitor and may allow him also to print out selected information on a small hard copy printer However the customer is not provided with anything like a fully fledged personal computer but only with a slightly intelligent terminal Usually his manipulative powers are limited to selecting different pages of data for display

This system resembles at least one of the British Teletext systems, except that the British system uses the vertical blanking interval of TV transmissions to insert the data signal rather than SCA channels (which incidentally can be encoded on the aural carrier of television stations as well as on FM radio signals)

However useful such systems are for market quotations and other very specialized purposes they are a poor model for general mass communications in light of the cultural energy values discussed above

By not providing the user with mass storage capability (as is inherent even in a book which each reader can own) nor giving him the manipulative powers of a general purpose computer digital broadcasting systems are really only another form of television broadcasting — one in which the words are printed instead of being spoken Although the use of printed text does somewhat depersonalize the information, this positive value is greatly offset by the tiny amount of information available to the reader at any given time and by the inability of the reader to restructure the content

Computer networking

Computer hobbyists often have proposed linking a great number of computers so that information and program can be exchanged On the surface this seems to be a powerful means of communication — and it certainly might be useful for small groups of enthusiasts

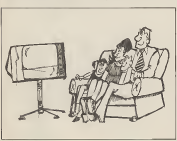
But it can be seen that this is nothing more than a tribal group communication — digital style It is both unstructured communication and bidirectional

Structure is energy we have noted and communication by group interaction is not structured (as in information printed in a book) We saw that even relatively structured broadcasting (standard radio and television stations) resembles tribal group communications in form Unstructured broadcasting (by radio wire, or whatever) by individual members of a group to other members is more tribal still

And anyone who believes that the egalitarian nature of such open mass communications provides benefits to the culture is invited to tune out their local radio stations for a week and listen instead only to the Citizens' bands

We observed that two-way communications has a levelling effect that discourages the creation of cultural energy potentials necessary to stimulate creativity and invention

All of this is not to say that a computer party line may not be fun After all, a major use of the telephone is for socialization and I don't want to give the impression that there is no point in letting computer hobbyists form networks I certainly do not oppose computer clubs My remarks



Tribal Society — 2

are addressed at those who seek to bring about the home computer revolution who seek to use the microprocessor to significantly enrich the lives of everyday citizens

Centralized information pooling

Why not hook up personal computers or terminals to a huge database and let each user call out the data he needs as he needs it? It would be like giving everyone access to their local library right from their homes

Although this type of computer communications scheme is far stronger than the other two discussed above it still fails to provide all of the cultural energy gains that are possible with personal computer based mass communications

Let me note first in passing, that any large scale project to hook up every home to one giant information center would be an engineering *tour de force* If the gains to be realised were great enough there might be value in such a great undertaking Certainly there are small scale specialized applications that would lend themselves to this approach But we will see that as a means of mass communication this structure still has shortcomings

It is similar to computer networking except that instead of having a large number of small computers talking to each other each computer interacts with a large centralized database

Although this scheme can be analogized as giving everyone access to a huge library perhaps it is more accurate to say it is like giving everyone access to a single giant book Since the database is the sole source of information, and since the structure of the information is provided by the creators of the database the role of the database is somewhat like the role of libraries before the invention of the printing press Requiring everyone to somehow be a "cardholder" to a central library again ties the information gathering process to some kind of group participation and two way communication

The printing press made books part of a very varied information distribution process Individuals can buy or trade books and build their own personal libraries as well as visit a centralized book repository People can also mark up or otherwise customize the information in their own books to make the information easier to retrieve and understand

Centralized interactive databases rob the individual of his own information storage and structure and certainly put much power in centralized hands to control the information flow to members of the data users group

Of course an individual could transfer all of the information he wants from the central source to his own mass storage and create his own database but then there is no need at all for the large centralized two way structure And in fact we observed that it is the *one way* communications structure of print that helps depersonalize it and give it greater energy potential So the interactive database is only an improvement over partyline networking in that the information available to each user is more highly structured Otherwise it suffers from being a neo tribal form

So what is the ideal ? Can the personal computer be the basis of a new communications structure that might return our society to literacy and energy? I think it can

A system with high cultural energy is apt to possess the following characteristics

1) Each computer owner would have access to many unidirectional information channels probably available through some kind of electronic broadcasting system

2) Each owner would have a huge amount of mass storage available so that he could create his own library

3) Each computer would be capable of great processing capability so that the large database could be managed effectively

4) The major symbols of this communication would be the printed word, augmented as necessary by pictures — still or moving — and sound (possibly) to convey only that information unsuited to the printed word (Obviously some kinds of computer — transmitted entertainment might be included in this form of information)

'We have seen that the advancement of cultures is related, in part, to the way information is exchanged within social groups '

The [illegible] it [illegible] the [illegible] a 24 hour [illegible] by the owner [illegible] computer TV Guide In addition tapes could be sold or ex[illegible]

Whether [illegible] system is likely to be [illegible] the future is not of immed[illegible] What is important is that people [illegible] computer communications [illegible] understand what forms of communication provide the greatest cultural energy and that hardware manufacturers direct at least part of their attention to communications goals

[illegible] not wish to suggest that computer communications will replace [illegible] television as forces in our society [illegible] never replace the old Television did not replace radio but it did [illegible] change in the role of radio programming (and thus in the *content* also of the programs)

Although some well-known writers have proposed banning television some of the socializing effects that make radio and television culturally weak as sources of information may actually have benefits in satisfying some of our entertainment and emotional needs

But what I am suggesting is that we enrich our communications capability and advance our culture by implementing communications that provide the greatest possible energy And if paper shortages like the one we are presently experiencing re occur and get worse the urgency of effective electronic communications will increase Computer based systems should be designed to meet these human needs instead of asking human beings to accept an information structure based on technical expediency

(It seems likely that Prestel and similar services fit the author's specifications — Editor)

Summary

We have seen that the advancement of cultures is related in part to the way information is exchanged within social groups Writing advanced man beyond the limitations of pre literate tribal cultures but it was the invention of the printing press and thus the invention of mass communications that permitted the development of high cultural energy potentials capable of great innovative power

But whatever the benefits of radio and television as information distribution systems they represent a step backward toward the tribal society and high cultural entropy

Computers are powerful information manipulators The availability of low cost personal computers could lead to a new kind of electronic communications more powerful even than print as we know it But most systems of personal computer communications that have been constructed or proposed so far fail to provide a level of cultural energy that could offset the defects of present day broadcasting

This article began with a quotation observing that the intended atomic age became the computer age Perhaps with the development of personal computer based mass communications we will be saying some three decades from now It was to have been the television age It became the microcomputer age

Notes

(1) Bode R , *The Computer Age* **(International Business Machines Corporation) Armonk, New York**

(2) **Hoffer** Eric Reflections on the Human Condition **(Harper & Row) New York 1973**

(3) **Ogdin Carol Anne** *Software Design for Microcomputers* **(Prentice-Hall Inc) Englewood Cliffs, New Jersey 1978**

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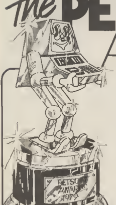

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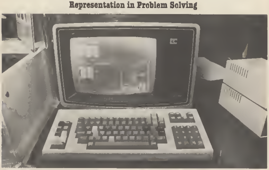
Figure 1

TOPICS IN ARTIFICIAL INTELLIGENCE

PART ONE:
Representation in Problem Solving



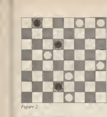


Figure 2

In this article he discusses the structuring of problem data, the form of the problem and its representation, leading on to a next stage, the problem of forming a strategy. Dr Fairhurst is at the Electronics Laboratories, the University of Kent at Canterbury.

This is the first in a short series of articles which follow up some of the points raised by Professor George in a previous issue (*December 79*). In his article Professor George explored in a general way some questions which are raised when we try to make machines behave in an intelligent way. In this and subsequent articles we shall take some of these ideas and examine them in greater detail and at a practical level.

It is self-evident that constraints on available space will prevent a detailed and rigorous exposition which would be necessary adequately to survey the whole range of current and imminent achievements in the exciting field of artificial intelligence. That, however, is not the purpose of these articles, nor would it be desirable in this particular context. The aim is rather to demonstrate possible approaches to some of the very thorny problems which begin to loom large as soon as we attempt to get to grips with the practicalities of endowing a machine with a capacity to behave intelligently.

> *'We must first come to terms with the problem of how to represent information and processes in a way which is meaningful for the machine'*

When [illegible] artificial intelligence [illegible] helpful [illegible] and a [illegible] by the [illegible] program such as this we should have to consider a whole range of problems: what

Artificial Intelligence

and valid moves for each piece, what constitutes a good move, what is the ultimate object of the game, are there any strategies which are know to be effective, and so on.

All this is difficult enough to handle. However, before we can begin to solve these problems we must recognise an even more fundamental difficulty. If our aim is to pass on such information to a machine (a computer, for instance) then we must first come to terms with the problem of how to *represent* information and processes in a way which is meaningful for the machine, and decide on a form in which the problem solving strategies we devise can find appropriate expression. Indeed, this is a primary requirement for any artificially intelligent system.

In this article we shall ask three questions:

1. **How can we give a structure to the items of information which are to be manipulated in solving a particular problem?**
2. **How can we define a problem in a way which will offer the best chance of a satisfactory solution?**
3. **What techniques are available for representing a problem in a systematic way which allows the planning and execution of a strategy for its solution in an optional way?**

To clarify these basic considerations we shall take each in turn for closer examination.

Structuring the problem data

In programming a computer for even the simplest task we have to consider how to represent the data we are dealing with. For example, if we write a program which simply adds together two numbers then, if the program is to be in any sense general purpose, we define variables using fairly arbitrary symbols to which can be assigned any two numerical values we care to input (e.g. INPUT A, LET S = A + B etc).

We sometimes wish to retain a common identity among a group of variables while allowing for individual differences. A convenient device in this case is to use an *array*, as for example in a program which requires that we store information about the number of days in each month. An array M with twelve elements M(1), M(2), M(3) ... M(12) might be useful in this case if we assign to the variable M(1) a numerical value of 31, to M(2) a value of 28, and so on. (How would we deal with the difficulties arising in a Leap Year?)

Some data, however, is more conveniently organised in a two-dimensional array. Look at the draughts-board shown

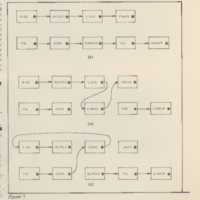


Figure 3

4	9	2
3	5	7
9	1	6

Figure 4

in Figure 2 We could represent the current state of play by defining an array D(X Y) where each argument (X Y) of D, points to a row and a column of the board Thus D(1,1) D(1 2) D(1,8) correspond to the eight squares on the first row of the board, D(2 1) D(2 2), D(2 8) to those of the second row, and so on We could then assign values to elements of D which show the state of each particular square such as a 0 to signify an empty square a 1 to signify its occupation by a black piece and a 2 for a white piece In the example shown D(1 2) D(3 4) and D(7 4) would have the numerical value 1 the elements D(1,6) D(1 8) D(4 3) D(5 8) D(6,5) and D(8,5) would have the value 2 and all the remaining elements of D would take on the value 0 Can you see any inefficiency in this representation?

In writing programs – and particularly so in artificial intelligence programs — we are often very concerned about the *relationships* between items of data This is often because we are manipulating symbols rather than numbers (the previous example tried to get round this by forcing a

Artificial Intelligence

symbolic notation – black and white pieces – into a numerical form) To deal more effectively with this type of problem it is often desirable to use an alternative and perhaps less familiar data structure the linked list

Let us suppose that we wish to manipulate sentences written in English Here are two possible such sentences

KING ALFRED LIKED CAKES
THE COOK BURNED THE DINNER

Using a list structure we may store a sequence of items such as successive words in our sentence by storing each item together with a *pointer* to the next. We can symbolically represent the storage of the two sentences above as shown in Figure 3(a) The asterisk is used to indicate that each item in the list (each word in this case) is stored together with a *pointer to the address* at which the next item is stored Here we have shown the actual linking by using arrows rather than actual addresses A major advantage of this type of structure is the ease with which we can modify the relations among items – in this case make up other sentences – simply by *changing pointers* This is evident if we look at the transformations in Figures 3(b) and 3(c) Think of the reorganisation which would have been necessary had we tried to use some form of array storage for this problem.

Structuring the form of the problem

Having considered the question of organising the available problem data in an efficient manner the next matter we must attend to is representing the details of the problem in such a way that we maximise the chances of devising an efficient and workable procedure for its solution The idea is easily illustrated by a simple example Let us try to derive a problem representation which will help us to plan a strategy for playing the following simple number game

Each of the numbers 1 2 3 9 is written on a card and the nine cards placed face upwards on the table Two players draw a single card from the table alternately The object of the game is for a player to pick up three cards which together total 15 The game is drawn if all nine cards are picked up without a score of 15 being achieved by either player

It should be easy enough for you to play this game intuitively but perhaps rather less easy to work out and specify exactly the rules you are actually applying through your intuitive reasoning However a simple transformation of the problem representation can make a suitable strategy much easier to formulate Figure 4 shows a so-called magic square This is a 3 x 3 grid of the numbers 1 to 9 arranged in such a way that the numbers in the horizontal vertical or diagonal straight lines all total exactly 15 If we now project our number game into this frame of reference in planning a problem solving procedure our problem reduces to that of specifying a strategy for playing noughts-and-crosses a problem familiar to practically everyone

Problem representation

Even having achieved our first two objectives above we still have to tackle a third major problem deciding how to represent the target problem we wish to solve in a way which is amenable to machine manipulation – for only when we do this will we be able except with the simplest problems to devise a machine strategy for its solution A very useful method of problem specification and a good starting point for strategy development is a *tree* representation

Let us consider another example A simplified version of the game NIM can be played as follows

Five straws are laid on the table Playing alternately each of two players must pick up at least one but not more than two straws The player who picks up the last straw loses the game In other words the object of the game is to force your opponent to pick up the last straw

We can represent the starting position of this game by drawing the five straws within a circle to define the current state of the game This we shall call a leaf (or node) of a tree Thus

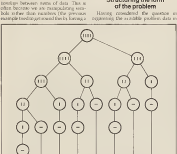
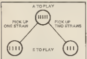


Figure 5

Player A is to begin. From this starting point he must opt for one of two possible moves, namely to pick up either one or two straws. These two possibilities and the consequences of each can now be represented by growing "branches" (or arcs) from the starting node as follows:



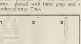
The same possible moves are now open to player B of course, but the state of play after B's move will depend upon what decision A previously made. Thus we can now extend the tree further by growing branches from each of the two nodes generated in the previous step. We can continue this procedure until ultimately we shall arrive at the complete tree shown in Figure 5. Several points of interest are apparent:

1. **The tree shows ALL possible moves over the entire game and therefore the consequences of decisions taken at any stage.**
2. **We can identify certain "goal" nodes or leaves. If, for example, the machine is allowed to have the first move, then goal nodes would be those tagged as "A" wins.**
3. **The tree allows stupid moves. For example, in a position with two straws left on the table, we nevertheless consider the possibility of the next player picking up both.**

Artificial Intelligence

Here then we have a very full description of the problem we are trying to tackle. Can you see some drawbacks to this method of problem representation? (Consider representing the game of chess for instance.)

In the above example we drew up a tree for a problem which was expressed in the form of a 2 game between two players. In practice, one player would be the computer we are trying to make behave intelligently. Other problems which involve a single "solver" can also be described by trees. For example another classical problem is "The Tower of Hanoi", played with three pegs and a number of rings. Thus:



The object of this puzzle is to transfer the tower configuration of rings from peg 1 to peg 3 with the help of the intermediate peg 2 as necessary, moving only one peg at a time and never placing a larger ring on top of a smaller ring. You should be able to see how to produce a tree representation of his problem, at least if you consider the restricted case of just two or three rings in the tower.

In this opening discussion we have raised some of the most fundamental problems which we must consider if we are to solve any practical problems in artificial intelligence. Having established some of the basic ideas we are now in a position to move on and see how to take advantage of our problem *representation* in order to plan a *strategy* for solving our target problem.

For example, how does the NIM game tree we produced actually help us to devise a means of programming a computer to play NIM? This problem of strategy formation we shall consider further in the next article. Having covered this initial ground we shall proceed in subsequent articles to examine some other major concepts and techniques in artificial intelligence including pattern recognition, machine vision, and machine understanding of speech and language.

Computer Age would be very interested to hear from readers who are doing practical work in Artificial Intelligence.

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- Time sharing
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- Point to point data communications
- DEMI systems

[illegible]

USING MICRO-CAL IN THE CLASSROOM

Through [illegible] the classroom [illegible] exciting [illegible]

The claims made for Computer Assisted Learning (CAL) are often exciting and persuasive, but the use of computers in this context is still largely [illegible] minority. The current thinking seems to maintain that microcomputers will prove to be the [illegible] which this minority will be [illegible] majority. If this premise is accepted an obvious question presents itself — how will the use of microcomputers effect this change? Will it simply be a case of making CAL easier to use or will microcomputers make new and better forms of CAL available for use in schools? The answer is probably a combination of both.

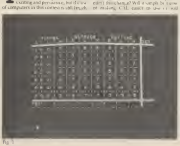

Fig 1

'What are the current constraints and difficulties of using mainframe CAL in the classroom?'

Before attempting a detailed answer it is a good idea to consider another fundamental question — What are the current constraints and difficulties using mainframe CAL in the classroom? Most teachers' answers would contain at least some of the points listed below.

- Most schools possess printing terminals from which video output is not possible, thus making the use of CAL material in demonstration mode almost impossible. In this way CAL is restricted to small group or individual use and tends to be used as an adjunct rather than an integral part of a lesson.
- Teletype terminals of the type encountered in schools are usually noisy and print slowly.
- A computer terminal is not portable. This is a great inconvenience when a

lesson is held in a classroom some distance away from the terminal

- Telephone links between a terminal and a mainframe computer are expensive Also there is often noise on the telephone line giving spurious characters in the output
- Computer systems sometimes crash — very frustrating and awkward when a CAL program is being demonstrated to a class of students
- When a time sharing system is being used response times can be very long during peak hours
- School terminals do not possess graphics facilities and thus students are deprived of the most stimulating and flexible aspects of CAL

The use of microcomputers can alleviate all of these problems to some extent

- Video output from a microcomputer is a standard feature

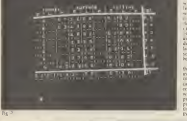

Fig 2

- Relatively cheap printers can be purchased for use in conjunction with a microcomputer These are both quieter and faster than teletypes
- A microcomputer system is completely portable
- As a microcomputer does not require a telephone link there are no call charges and no spurious characters in the output due to noise After the initial capital investment a microcomputer costs virtually nothing to run the only significant expense is the cost of cassette tapes or floppy discs
- It is not possible for a microcomputer system to crash in the same way that a mainframe system can
- The response time of a microcomputer is constant in the sense that it cannot be affected by other users
- Microcomputers have made it possible to consider the use of graphics seriously for the first time in the design of CAL material for use in schools

Schools

There are some disadvantages to using microcomputers Cassette based microcomputers can be very awkward to use when programs are being loaded This problem can be overcome by using more expensive floppy disc systems The low resolution graphics commonly available restrict the quality and type of graphical output possible As medium and high resolution graphics become more common these restrictions will ease However better resolution will mean slower response times Problems to do with the availability of micro software are bound to crop up as individual micro-computer users are faced with the task of collecting and maintaining a library of CAL programs One solution to this problem could be to develop some software [illegible] computer into [illegible] mainframe computer with its library of CAL programs

Providing the problems of software transferability can be successfully overcome the 'hardware advantages' of microcomputers over mainframe computers and their introduction of graphics should ensure that they are responsible for an increase in the popularity of CAL

In order to illustrate some of the points made earlier an example is given below of the development of a micro CAL package The package is really a demonstration package intended for class use by the teacher but in certain circumstances it is suitable for individual use

Relevance

For a CAL package to be used regularly it must be relevant to the school curriculum and it must either deal with an existing topic in a new way or make it possible to seriously consider a topic for the first time In other words the computer must be seen to be making a relevant and essential contribution to classroom teaching One developing area of the curriculum which is often difficult to teach is environmental studies Here the impact of technological innovation is frequently considered Most difficulties in this field arise because of the lack of realistic resource material Perhaps some form of computer simulation could help?

A package currently being developed by the Schools Council Project Computers in the Curriculum attempts to make a contribution in this area The package is called ROUTE and is concerned with the environmental impact of siting a motorway It is based on the microcomputer program ROUTE A similar mainframe program could have been developed but the package is considerably enhanced by the use of micro graphics

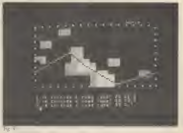

Fig 3

ROUTE allows a proposed route for the A1 through Hatfield to be devised The route is 'scored' environmentally in a manner based upon the user's own subjective ideas about the impact of a motorway on various environmental factors The program will also calculate the financial cost of building a proposed motorway An attempt to devise a route which satisfies the often conflicting objectives of low cost and low environmental impact can then be made

The program makes use of the environmental impact matrix shown below

Each row — labelled A to G — represents an environmental factor Any number of factors less than or equal to seven can be considered and the choice of factors is up to the user A list of seven suggested factors is given below

- **Noise**
- **Vibration**
- **Atmospheric pollution**
- **Severance**
- **Land take**
- **Visual intrusion**
- **Danger**

Each of the nine columns represents a category of road defined by the type of road and the area through which it is built A surface road a tunnel, or a cutting may be used in a rural region (R) a region of low density housing (L) or a region of high density housing (H)

Each element of the matrix is taken to represent the importance of the impact of a particular category of road on one of the chosen factors This importance is independent of any particular route — it merely expresses the user's opinion of how important the effect of a given road category is upon any of the specified factors Importance values should be subjectively assigned integer values between 0 and 9 Larger numbers represent impacts of greater importance When a route is chosen the importance values entered in the matrix are weighted by the program in accordance with the chosen route If the weighted importance values are summed a total environmental impact score is produced Row totals will give the separate environmental impact scores upon each factor and column totals will give the environmental impact due to each category of road An example of a scored matrix as shown below

The Commanda

SET	presents the user with the environmental impact matrix discussed earlier A question mark will be seen in the space representing the top left hand element of the matrix To assign an importance value to the element type in an integer number between 0 and 9 The question mark will move automatically to the position representing the next element, which can now have an importance value assigned to it If less than seven factors are to be considered a CR should be pressed when sufficient importance values have been entered (See fig 1)
ROUTE	produces a simplified computer map of Hatfield and allows a route to be specified White areas on the map represent regions of high density housing grey areas represent regions of low density housing and black areas represent rural regions A section of motor way is specified by giving the end co-ordinates of the section and the type of road Up to four sections can be used to complete a route Each section of the route is automatically drawn on the map when it is chosen (See fig 3)
SCORE	produces a scored environmental impact matrix for a given route and set of importance values Obviously an environmental score cannot be produced if either the SET or ROUTE command has not been used (See fig 2)
COST	produces a breakdown of the financial cost of a proposed route (See fig 4)
VALUES	produces a record of the current set of importance values and route details
COMMANDS	lists all the available commands
HELP	gives advice on how to use the program
FINISH	enables the user to exit from the program

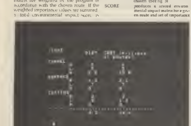

Fig 4

As is the case with all CAL programs ROUTE can only be used successfully if a certain amount of preparatory work is done Particular attention should be given to the way in which the various environmental factors could be affected, the meaning of the importance values and how routes can be chosen

Before using the program, relevant environmental factors must be identified The subject orientation of the exercise is largely determined by the choice and emphasis placed upon various environmental factors Thus noise and atmospheric pollution would probably be stressed in a scientific context severance and land take in a geographical context and visual intrusion in a design context Discussion of the environmental factors provides an excellent opportunity to use other resources such as film slides and written material

The importance values used to complete the matrix should be decided upon before the program is used It is a good idea to mark the values on a copy of the matrix so that they can be quickly and efficiently entered into the program

If ROUTE is being used in demonstration mode as part of a class exercise it is probably best to produce one set of importance values which reflects the general opinion of the class This class set can be produced by averaging the set of values produced by each student Different averaging techniques — ranging from arithmetic or modal means to class discussion — can be used for different factors A class set of importance values can also be produced by separating the class into discussion groups and instructing each group to produce importance values for each one of the environmental factors

Routes should be chosen before using the program In order to help students choose a route sensibly it is a good idea to ask them — individually or in groups — to draw the route on a copy of the printed map The end co-ordinates required to specify the route can then be easily worked out

The SET command should be used first Different routes can then be entered using the ROUTE command The environmental impacts and financial costs of each route can then be obtained by using the SCORE and COST commands respectively A reminder of the importance values entered in SET and the co-ordinates used to define the current route can be obtained by using the VALUES command

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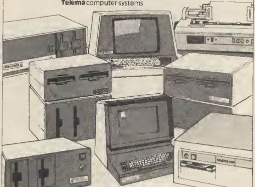

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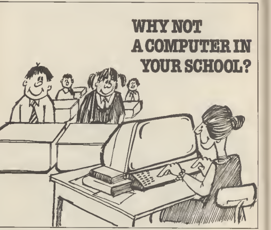

Enterprise is not confined to the entrepreneur. More and more teachers are taking up the cause of the micro and finding ways to introduce it to their schools.

To be asked to look after a computer for the use of all schools in your Education Authority is everyone's dream, but this is exactly what happened to me.

Educated as an average 'A' Level candidate in mathematics and Physics at an all girls grammar school, I had had the opportunity during my sixth form career to help pioneer a computing course link between five local secondary schools and Southampton College of Technology. I had enjoyed this very much and decided to do computing or computer studies as part of my degree course at Liverpool University, little knowing where it would eventually lead!

Having completed my course at University, including vacation work in Enschede the Netherlands [illegible] research for the Dutch [illegible] gaining my degree and a Certificate of Education in Mathematics and Ph[illegible] I started to teach Mathematics [illegible] games in a Liverpool Comprehensive School. My interest still lay in computing, but the opportunities did not arise for several years until I changed my teaching job.

> 'Everything is still embryonic. Money everywhere is tight and in this my Local Education Authority is no exception.'

Now I was teaching mathematics in an all girls comprehensive school, and as part of the C.S.E. Mathematics course there was an option of course work on various subjects instead of an examination for Paper Three. Locally, a group scheme under the Merseyside Schools Computing Centre was setting an option within the North West Regional Examination Board Mathematics Syllabus A for Computer Studies course work instead of the Paper Three examination. This was the option that I chose.

My career in teaching Computer Studies Science had begun.

During the following few months I taught Computer Studies as part of the Mathematics course and became well involved with the activities of the local Schools Computing Centre. At this stage all programming was batch processed. A local business firm then offered several minicomputers for use in schools locally. The decision was taken that these were to be distributed between the Local Education Authorities which exist in Merseyside. One was to come to my Authority. Several weeks later I was asked if I would look after our machine.

All Local Authority schools within the area were to be able to use the computer once their staff had attended an introductory course on both the uses of the machine and how to program it. I was to run these courses after I had attended an initial training course during which I would learn the whys and wherefores of the machine. Obviously the pupils I taught in my own school where the computer was were going to get a fair portion of time on it. This meant also that they suffered the problems of the machine going wrong — which it did for quite a while after installation. These problems are behind us now and the pupils are still coming back for more computing.

That was just over a year ago. Now I have half a timetable to teach in the school, during the other half I work for the Education Authority trying to promote Computing within the local school communities, both as a subject in its own right and within all other areas of the curriculum. Everything is still embryonic. Money everywhere is tight [illegible] the [illegible] Local Education Authority [illegible]. The original idea of having [illegible] for use by pupils either at [illegible] point (the Computer Resources [illegible] being developed) or for loan [illegible] set period of time has had to [illegible] ed at present. The thought still [illegible] though particularly after one [illegible] heard George Hubbard, Director of CET (Council for Education Technology) say:

'Some pupils will want to study the theory or applications of computers in detail.'

We need to give young people such opportunity as we can to experience the effect of microelectronics, to become familiar with their potential, with what they can and cannot do. There are two main strands to this. The first is to bring microelectronics, in the form of the microcomputer, into the everyday work of the school, into its administration and management, into the teaching of a wide range of subjects both through the application of computer assisted learning and through the exploitation of the various computer based information systems (PRESTEL, CEEFAX/ORACLE and BLAISE for example) which are now becoming available. The second is concerned with the actual applications of microprocessors in equipment, their use in the laboratory and in the development of projects and devices.

In order to satisfy this, the computer must be reliable, accessible and easy to use. There must be a library of well written programs to meet all the recognised needs in education. Also, funds must be adequate to support use of the computer throughout the year. And there must be adequate support services.

The initial computer system should contain 16K-24K bytes of memory, a cassette recorder, a VDU controller and several TV sets as monitors so that the whole class can see what is going on at the same time. Classroom teaching is important.

There are various disadvantages of this system as it stands. Any files contained on tape cassette can only be retrieved by finding and loading the correct cassette and playing it at 30cps (serial access). This is much slower than disc retrieval (direct access) but is normally quite acceptable on small files. For school administration purposes, however, I doubt that this would be fast enough. Certainly in a project I have been doing with several local teachers to sort out examination results and place them in descending order of mark or in alphabetical order, yet when lists have been placed on file, once we had more than fifty names the task became very slow and laborious on cassette tape. It would have been much faster on disc. Where possible, discs should be introduced into the system as soon as is financially viable.

Another problem is that a VDU does not produce a printed output to use as a record of results, perhaps for CSE or O or A level examination purposes, or to use to examine programs away from the keyboard. Often a hard copy is required, so a printer has to be added to the system. I have a minicomputer system of a CPU, VDU and a printer, but there are times when I wish that the system could contain more than one VDU so that I could use the machine for class teaching, and also that more keyboards could be attached so that more than one pupil could use the computer at a time. This is certainly something to watch for when choosing a computer system.

Accessibility of several keyboards and ability to use several VDUs (or equivalent) attached to one machine is a distinct advantage and need. The possibility of one terminal on-line to the computer and several off-line keyboards for typing programs or data onto cassettes or discs is viable — and desirable.

Many people now ask, 'What could a computer be used for within the school?' The objectives I would set are:

- **to support the teaching of Computer Studies**
- **as a teaching aid for subjects other than Computer Studies**
- **as a tool for school administration**
- **but mainly for** *General Education*

Before they leave school, all pupils should:

a) know what a computer or processor is and how it is organised
b) know what a program is and why it is used
c) know when it is useful to use a computer processor and when it is not

These aims could be covered in a general course or by introduction into all subjects in the curriculum throughout the school.

Some pupils will want to study the theory or applications of computers in detail and for them there are examination courses in Computer Studies or Computer Science, but this is not the main objective.

How the introduction to computers is organised and developed will depend on the school and the expertise available. Once the computer is available everyone will want to use it, or at least that is what I find. At present we have very good links with the local Polytechnic and College of Technology Computing Centres where most of our work is done. You may ask why. Well...

A minicomputer/microcomputer tends to be a single user machine at the level we can afford. Also very seldom does it have hard copy (initially anyway) and what the pupils want is to be able to take their work and results away. They are not trained yet to use a computer as a tool rather than as the final product.

'Computers are generally introduced into schools as a result of pressure from an enthusiastic teacher.'

As a way of training the pupils to use the computer as a tool and as part of what I see as general computer education, I have introduced the History Department in my school to two computer packages run on the local College of Technology computer using the ICL-FIND 2 package. These are files listing the Death Register of a church in Colne, Lancashire[1], for the years 1790-1812 and the Census return of St. Nicholas Parish Church, Ipswich[2] for the year 1851. The Death Register file was used last year with a class of fourth year Mode 1 History CSE pupils in a study of causes of death during the early nineteenth century. This year we hope to use it again within the structure of the 'O' level and CSE History courses with the fourth and fifth year classes. The Schools Council History project for 'O' level involves an option on Medicine, and we are hopeful that we can draw conclusions about how medicine has altered the main causes of death in this country by using the Register as typical of causes of death in the nineteenth century.

The other side of this cooperation involves general computer education. I am hopeful of showing the girls that they can take the slog of going through the records individually to the computer and get it to produce neat concise replies to their various questions. They certainly learn that they only get replies to the actual question they ask and not to the one they meant to ask.

The other [illegible] I have appear[illegible] [illegible] the [illegible]s are begin[illegible] [illegible] reply [illegible] [illegible] in response [illegible] [illegible] ideas [illegible] probably [illegible]

[illegible] opportunities [illegible] with the Geo[illegible] [illegible] help with [illegible] has been [illegible] the com[illegible] [illegible] the CAPE [illegible]

[illegible] computer is [illegible] work [illegible] the [illegible] given [illegible] and [illegible]

[illegible] programs are [illegible] the programs [illegible] come [illegible] interest [illegible] All programs [illegible] must be short enough to hold the pupils' attention. This is where teachers who have had experi-

Experience

ence in writing programs for pupils' use can help those with less experience in this field. Within MUSE[4] a software library has been developed of programs relevant to courses running in schools, which may be useful to other teachers. I am not saying don't use the computers in the curriculum packages, but they are certainly running better at present on an interactive terminal to a larger machine. I believe many of these programs are being adapted for use on the PET and Research Machine 380Z with good results, though, and I look forward to these. Another source of ready written programs is the Central Program Exchange[5] at Wolverhampton Polytechnic, run by Graham Beech.

The major problem with all this information is how to spread it among the people who could best use it.

Computers are generally introduced into schools as a result of pressure from an enthusiastic teacher. The computer and its use will often then be monopolised by that teacher and so his interests are dominant. The worst possibility is that he is crazy about computers and wants to indulge himself and probably amaze others by what he can make it do. Any educational advantages would accrue then by accident. The best possibility is that the teacher who is more enthusiastic about the educational aspects of the computer is given the responsibility (and some time *outside* lessons, most important) to organise the most worthwile configuration of uses in the light of needs and resources. This is hopefully what I am trying to achieve by assessing the programs available and getting copies where possible of those suitable, so that, when approached by a member of staff of my own school or another, I can produce what material there is, or if nothing else is available, can perhaps start to write a suitable program. However, it all takes time, and most teachers still seem to think that a computer program can be written overnight.

That is the next hurdle to be faced.

References

1 The Colne Burial Register 1790-1812. Further information from Blackburn College of Technology and Design Computer Centre.
2 The Local History Classroom Project 1975-1977. Further information from B. D. C. Labbett (Project Director), c/o Centre for Applied Research in Education, University of East Anglia, Norwich NR4 7TJ.
3 GAPE (Geography Association Package Exchange). Further information from David Walker, Dept. of Geography, University of Technology, Loughborough LE11 3TU.
4 MUSE (Minicomputer Users in Secondary Education). Further information from Charles Sweeten (Hon Sec), 18 South Road, Oundle, Peterborough.
5 CPE (Central Program Exchange). Further information from Graham Beech, The Polytechnic, Wolfruna Street, Wolverhampton WV1 1LY.

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12 Exam/Create Product Sales
13 Print Customer Statements
14 Print Suppliers Statements
15 Print Agents Statements
16 Print Quarterly Statements
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A SIMPLE DIVISION ROUTINE

[illegible]

R[illegible] at school [illegible] ed [illegible] sion and the [illegible] ent was that although he had learned his times tables up to at least 5 times the actual concept of multiplication had not been properly understood I am not a teacher but I succeeded where conventional teaching failed by writing the program for my boy on my Challenger computer

I[illegible] the problem is that children [illegible] and the [illegible] escapes [illegible] times two [illegible] eight" or [illegible] the [illegible] has [illegible] does not [illegible]

The [illegible] from multiple [illegible] the answer for the division [illegible] If the child gets it wrong the [illegible] times table is flashed up up to the point where he/she went wrong, then asks the question again in the same line Take your child through this procedure and point to where the answer is (ie on the bottom left of the table) Make sure (s)he reads the table from the top — the tendency is to read only the bottom line on the screen Then leave him alone

The child must get all the questions right first time — first time answers are stored in array and checked each time — then the computer will move on to the 3 times table and so on If the child gets the question wrong even after being shown the table then the computer abandons it and tries a different number Dwelling on the same question can trouble the child

Children can so easily form a mental block out of fear of the interaction with an adult The computer displays no anger or disappointment and turns the whole thing into a challenging game

The program uses Microsoft Basic which should run in a PET or Challenger though you may have to shorten the PRINT text to get it on your screen If possible use lower case which is more friendly and easier to read The PRINT instructions with no argument space out the lines, making them easier to read Put in more if necessary

Computer Age welcomes simple routines written for children — and articles from boys and girls in school However printouts must be very clear

```
10 DIM A(12):Y=1
20 FOR X=1TO12
30 A(X)=0
40 NEXT X
45 Y=Y+1
50 F=1:REM PASS FLAG
60 FOR X=1TO12
70 IF A(X)<>X THEN F=0:REM FAIL
80 NEXT X
90 IF F=1 THEN PRINT: PRINT"YOU KNOW THEM ALL!":GOTO 20
100 X=INT(RND(1)*12)+1
110 Z=X*Y
120 PRINT"What is";Z;"divided by";Y;
130 INPUT A(X)
135 PRINT
140 IF A(X)=X THEN PRINT"RIGHT":GOTO 50
145 PRINT
150 PRINT"WRONG"
160 FOR N=1TO X
165 PRINT
170 PRINT N;"TIMES";Y;"=";N*Y;
180 NEXT N
190 PRINT" so what is";Z;"divided by";Y;
200 INPUT A
210 IF A=X THEN PRINT"RIGHT":GOTO 50
220 PRINT:PRINT"WRONG. TRY A DIFFERENT ONE":GOTO 50
```

Computer Age

If this is the first time you've come across **Computer Age**, here's some of what you missed in the first issue:

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THE PERIPHERAL CONNECTION

This month, the author looks at Disk Drives for microcomputers

David Shear is a Product Marketing Manager with Data Recording Equipment Ltd (DRE) [illegible]

Now that we understand the specifications of disc drives, a review of the types available on small computers can easily be undertaken. Starting at the lowest capacity, we have 5¼" floppy drives, often found built into the basic terminal or system cabinet. These units are very low in performance but also low cost; however, the cost advantage over 8" units is not usually enough to prefer their use in anything but the very cheapest systems.

> *'There are many traps to catch the unwary'*

Eight inch floppies are really the standard solution for small systems. Performance is reasonable under single user situation, and with two drives fitted the on line storage capacity can be enough for reasonable file lengths. Up to 1.2 Mbytes of formatted storage is available on the latest units using double sides recording. This gives a system capacity on line of 2.4 Mbytes on a standard two drive system, which neatly reaches the bottom end capacity of the hard disc drive range. There is not much to choose from among the various mounting arrangements for the floppy drive, except that when mounted with the loading slot uppermost, dirt and paper clips and suchlike have a habit of falling in. Mounting near to the floor should be avoided as dust is easily stirred up at this level.

Pr[illegible] Serial Matrix Printer [illegible] 6520A

Two standard bit densities are available, the so called single and double density versions, with many data format variations within these. There are many advantages in choosing a system offering IBM compatible formats, as this is a *de facto* standard which tends to be widely copied, allowing diskettes to be transferred between systems. If such a claim is made for a system it should be thoroughly investigated, if possible by demonstration, as there are many traps to catch the unwary.

Moving up to hard discs, there are two types available in the next capacity range. The first we shall consider are the cartridge disc units, which have either a front loading or top loading cartridge, sometimes with [illegible] fixed discs, from one to three. Formatted capacities of these drives vary from 2.5 Mbyte to 10 Mbyte per platter, and the 5 + 5 Mbyte FEDS is probably the most common.

Front loading units have an advantage in convenience, particularly when mounted in a rack, but it is generally accepted that top loading 5440 types are a sounder design from the point of view of internal drive cleanliness. Top loading units can be mounted in a rack, but have to be pulled out to gain access; a separate low cabinet with a lift up lid is often a preferable solution. Some manufacturers' drives have a reputation for being particularly rugged and reliable, and you should never be afraid to make some independent enquiries of drive manufacturers after finding out whose drives are used in the system you are considering.

Perhaps better suited to microcomputers, but newer and not yet widely available, are low cost fixed Winchester disc drives. These vary in capacity from around 5 Mbyte to 40 Mbyte, in both 8" and 14" versions. Coupled with a floppy disc or cartridge tape for back up and media interchange, these units point the way for the future 'fit-and-forget' requirement on micro systems. No maintenance is required on these units (except when they fail of course) and the quoted MTBF (mean time between failures) is unusually 2 to 3 times as high as the standard cartridge disc drive. The widest variation in specification of these drives is in access times: two approaches have been used for the positioner. The lowest cost, lowest performance versions use floppy disc style stepper motors with an open loop servo, others use a smaller version of voice coil positioners, both linear and rotary types, with a closed loop servo. The higher capacity units with the best potential for future development is with the high performance versions, whose market prices will in any case be kept down by the mere existence of the low performance drives.

Try to make an intelligent choice with an eye to the future, in terms of both system expansion capability and the soundness of the drive manufacturer.

Many of the newer drives come from new, smaller suppliers, some of whose futures must be considered suspect.

Stepping up to the higher capacities, from 30 Mb to 600 Mb, there are three types of drive. Larger versions of the Winchester fixed discs are available, along with 3330-II technology versions of the FEDS and 3330-II exchangeable pack drives. All of these drives are 14" disks, apart from one manufacturer who uses 10" discs with embedded servos. All of these drives are relatively expensive for small microcomputer systems, but are the only answer to large database requirements. It is probable that the FEDS versions of these drives will take over the market from the older 2315 and 5440 technology drives during the next 2 to 3 years.

When choosing which types of disc drive you want on your system, keep an eye to future development and ask what plans the supplier has for changing or upgrading the disc storage on the system.

Interfaces and controllers

Disc drives we should now understand better, but just how do they connect up to a system?

Disc drives do not attach directly to the processor; they do so via a disc controller. This is merely an electronic circuit board (or boards) which translate computer instructions into control signals for various drive functions, and handle the flow of data to and from the drive. In addition they handle various signals supplied from the drive, such as fault conditions.

Peripherals

Controllers can be simple, smart or intelligent. The trend today is towards smart controllers, that is to say they handle a wide variety of tasks, often microprocessor controlled, and perform sophisticated functions within themselves. Such functions can include error correction, simple file handling, off-line copying and so on, limited only by the imagination of the controller and systems designers. A further refinement will be to allow the controller functions to be loaded by programs most appropriate to the particular systems application to be performed. At this stage the controller can be said to be truly intelligent, and the overall systems power is in effect distributed, part being resident in the microprocessor program in the controller.

Even this does not finish the connection story, however, as the controller has actually to be connected to the drive via a cable, and the signal definition across this cable is called the drive interface. To allow disc drives and controllers to be non-specific to particular manufacturers, a range of *de facto* standard interfaces have evolved. This allows the relatively easy change of disc drives of different manufacturers and offers a degree of protection to system builders and users alike. Today there are three basic standard interfaces, the floppy disc interface, the cartridge disc interface and the SMD (Storage Module Drive) interface. Probably 90% of disc drives available on small systems conform closely to these standards.

You may ask how relevant is this to the user, but consider what happens if your disc drive is non standard. The drive repeatedly fails and the systems supplier cannot connect alternative manufacturers' drives due to the non standard interface. The problem will seriously affect you, the user, even though you may rightly conclude that no blame attaches to you. The moral here, as elsewhere, is simple: recognised standards allow a wider initial choice, more protection in the case of problems, and interchangeability of data and disc units.

Some of the newer, low cost fixed disc drives may force the evolution of a new interface standard, but until this occurs some risk may be suffered by all parties concerned. There is no correct solution to the interface problem to suit all requirements, but bear in mind the limitations of each approach and enquire on the provision of further controllers for other drive types if you need them.

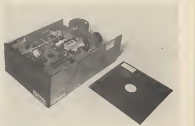
One last point concerns connection schemes, and that is the cabling arrangements. Daisy chain connections link each drive to each other in a chain back to the controller; radial or star connections link each drive individually to the controller, and some units have two cables, one radial and one daisy-chain. Any of these are perfectly acceptable to a user, but have cost consequences for the supplier.

Other considerations in choosing a disc drive

A few other considerations, not covered in the preceeding paragraphs, are worth mentioning, although some will obviously not affect every user.

Power supplies Most disc drives require an A.C. power input, but some use this merely to derive D.C. supplies for all uses including motors. In this latter case the drive can be easily changed to operate on 115 volts A.C. supplies and 60Hz mains frequencies. Drives with A.C. motors (commonly for the spindle drive) usually require the replacement of pulleys, otherwise the discs will revolve at the wrong speed when the mains frequency is different to that specified.

Spindle drive These may be direct (usually when a D.C. motor is used), built



8in Floppy Disc Drive Double Sided Models 7200 into the spindle itself or they may be via a belt This may of course break slip off and generally create a nuisance Belt technology is much better than a few years ago, but this is still a point to consider when reliability is paramount

Air filters To be affective air filters must be changed regularly — it is well worth investigating whether you can do this for yourself

Maintenance Most drives require some sort of preventive maintenance It is well worth finding out what the drive manufacturer recommends, and cross checking this with the system suppliers proposal

Simple tips on looking after your disc drive

Probably the most effective way to help any user here is simply to list a few "Golden Rules"

1 Keep the drive, media and surroundings CLEAN
2 Store media away from heat electrical interference sources magnetic fields and dirt
3 Where applicable make sure the air filter is changed and the heads are cleaned regularly
4 Ensure the interchangeability set-ups are regularly checked
5 If you suspect a head crash call an engineer and do not use the suspect drive or disc until they have been checked
6 Ensure your systems maintenance organization has the appropriate tools, expertise and spares to maintain disc drives
7 Look for recognised standards for interfaces media types and data formats

Disc drives are expensive, precision instruments — in general they will tolerate little abuse — so look after them problems can be expensive in terms of money and lost data

> *'Try to make an intelligent choice with an eye to the future, in terms of both system expansion capability, and the soundness of the drive manufacturer.'*

Into the future

Today there is a large upswing in the development of new disc drive technologies New techniques are aimed at smaller lower cost units with greater and greater capacities and much further development can be expected

The two major developments in magnetic recording are in the area of heads and disc coatings Thin film deposited heads are becoming available, promising cheapness and higher track and bit densities This is coupled with the development of plated discs with much better resolution than today's oxide coated platters Optimists in the industry predict that several thousand tracks per inch and up to 50 000 bits per inch are ultimately within reach Although basically this is likely to be only available on fixed discs the development of a cheap, sealed exchangeable recording chamber could usher in a new breed of unit

The application of microelectronics into disc drives is well under way but has much potential in the future It is not inconceivable, that with deposited heads a processing chip could be mounted directly on the head assembly to do first level processing, with further intelligent file handling functions performed further back in the drive This is obviously the level where drive designers and system architects need to inter relate at a fundamental level

The oft predicted demise of the disc drive and its replacement by solid state devices looks like being delayed well into the 1990s if not indefinitely Even then the development of optical discs could change the picture even more drastically — but that is another story

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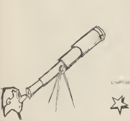


☆ LEARNING FORTH ☆

Continuing the series on the language invented by astronomer Charles H Moore

Series

In this article Gil Filbey discusses the Stack, the Building technique of FORTH and gives a number of practical examples. You can follow with pencil and paper if you don't have a computer handy

ECHO SLOGAN FORTH GRAFFITO HELP!

Forth is a high level programming language designed for small computers. It has been in existence for some years and has a following in America but is only just beginning to appear in Britain. The main advantages of FORTH are

- It requires only a small amount of memory
- It is fast
- It lends itself *naturally* to structured programming
- It is virtually *machine independent*

I propose to illustrate the use of FORTH by showing a program and what it does then discussing how it does it. The implementation I am using is APPLEFORTH V1 5 on cassette. I also have APPLEFORTH V1 2 by Programma International though I have not made much use of this version yet. Both these versions are also available on disk

Logically at this point I should explain the use of the editor. FORTH has a powerful editor but I assume that the majority reading these articles will not yet possess any version of the language and in any case the editor system varies from version to version. So for the time being I will stick to pencil and paper problems

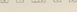
The stack and how to handle it

I dealt last month with the Dictionary, which may be likened to a tool cupboard. I now want to discuss the stack which is rather like a workbench on which the materials are placed to be worked. The materials in this case are numbers. If I type a number and hit the RETURN key this number is placed on the stack. Further numbers can be placed on the stack in the same way. There is no need to hit RETURN between each and the next so long as a space follows each entry. Numbers are dealt with in the reverse order to their entry by the use of the dictionary words. For this reason it is called a LIFO stack (Last In First Out)

Example

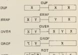
```
1 2 + . RETURN 3
```

The diagram showing the state of the stack in the above operation is (E stands for empty)



FORTH provides a number of words specially for manipulating the stack.

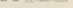
Examples



There are some more complicated ones which I shall describe later

These words may be combined by typing them in succession either immediately or within a colon definition

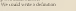
Example



Which has the effect of duplicating the top two stack numbers

We could write a definition

```
: 2DUP OVER OVER ;
```

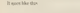


The word 2DUP can be retained in the dictionary for future use

Suppose we place the numbers 1 and 2 on the stack in that order and then repeatedly operate with 2DUP + . The state of the stack after six such operations is

1	2	3	5	8	13	21	34

It goes like this

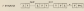


To see these numbers make use of the print word (a full stop) eight times in succession at the end and the numbers are printed out in the reverse order The sequence is known as a Fibonacci sequence and if you want to find out more about the fascinating properties of this sequence you should read Patterns in Nature by Peter Stevens in the Peregrine Books series

You cannot go far with the above sequence produced in this way without filling the stack (about 60 entries) A better way is as follows

```
FIBONACCI DUP ROT +
```

This defines the word FIBONACCI and produces a state diagram like this



After successive use of this word the stack contains only the last two terms of the sequence If you wish to print out the sequence term by term then define FIBONACCISHOW

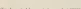
```
FIBONACCISHOW FIBONACCI DUP .
```

The final DUP here is necessary because the print word will remove the top stack number but we want it still there to produce the next term in the sequence

A Fibonacci sequence is useful for producing random numbers We define RANDOM

```
RANDOM FIBONACCI 25000 MOD
```

starting with a pair of seed numbers on the stack and then invoking RANDOM will produce a number between 0 and 24999 MOD is a FORTH word which causes the second stack number to be divided by the top stack number (in this case 25000 but you can choose any number you like) and the remainder only is retained A typical state diagram would be



(For brevity I haven t shown that 25000 is placed on the stack before the command MOD is obeyed)

I may now print successive random numbers by

[illegible]

Should I want to print [illegible] out a loop [illegible] I could [illegible] defining R

```
R RANDOMSHOW
```

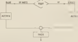
I might thus use a seed pair such as 1234, 2345 R R R etc Each R producing a printed random number

You can see that FORTH lends itself naturally to structured programming since each definition is short and contains words previously defined — good top down design. However the task has so far been easy since the only departure from straight-line programming has been the DO LOOP

We will now develop the branching technique as used in FORTH

IF ELSE THEN

The structure here is interesting and different from that used in most other high level languages Here is the flow chart



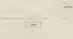
In contradistinction to other languages THEN is

What is done next in *either* case

If you like the sound of it better define IFNOT & IFSO

```
IFNOT ELSE
IFSO IF
```

You don t have to accept the words which come with the package You can use your own If no action is to be taken in the ELSE (or IFNOT) case then ELSE is dropped but it is still helpful to picture the flow chart as



The word THEN is obligatory after IF

A typical TEST is the relative size of the top two numbers on the stack To make a problem of it we will try to define a word called ORDER which arranges the top two numbers X Y so that the top most is smaller than the second The FORTH word asks in effect is X smaller than Y?

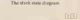
The test removes the numbers however so if we want to keep them we must use 2DUP first

The following defines ORDER

```
ORDER 2DUP < IF SWAP THEN
```

The next command after THEN doesn t need stating at this stage It will be stated by whatever word follows ORDER in the next definition

The stack state diagram



The final result will be in the order LARGER SMALLER

The opposite word REDRO (ORDER backwards)

```
REDRO 2DUP > IF SWAP THEN
```

I will leave it to you to show that the defined word MIDDLEDROP

```
MIDDLEDROP ORDER ROT REDRO
ROT ORDER DROP
```

will reject the middle number out of the top three on the stack leaving only the least and the greatest in that order so that a print-out of the result would give GREATEST LEAST This will be true whatever the starting order Show also that if there are N numbers on the stack then N 2 applications of MIDDLEDROP leaves the two extremes only on the stack at the end They can then be printed or further used

Here is a print out of the use of the word TESTS

```
TESTS 0 DO MIDDLEDROP 2DUP . . 1 ON
LOOP
```

It prints out the current candidates in pairs as it goes

We can now generate random numbers by the FIBONACCI word and sift them by the word MAXMIN

```
MAXMIN 0 DO MIDDLEDROP LOOP
```

Typical result

```
1234 2345 50 RANDOMS 50 MAXMIN
```

We can defind LOTS

```
LOTS 0 DO 50 RANDOMS 50
MAXMIN LOOP . .
1234 2345 20 LOTS
```

does 20 batches of 50 random numbers with each batch using the MAX and MIN of the previous batch as a starting seed The final print out is the GREATEST and LEAST of Random numbers

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FROM BABYLON TO BINARY

[illegible] beginnings

Numbers and Counting

Numbers are so familiar in every day life that we seldom stop to think about their significance or their origin. We use them countless times a day to count money, tell the time, arrange items in a sequential order, etc. We tend to forget that without numbers there could be no quantitative measurement, no monetary systems, and no calculations.

Early man met the need for counting the number of days between two successive events such as a full moon and also he probably wanted to know the number of sheep in his possession and perhaps how to divide them among his children. To solve these problems, he devised a number system which, today, we call a tally system. This system uses one symbol — the scratch mark or tally. One tally is used for each thing being counted, one day — one mark, three sheep — three marks and so on. This analogy between the number of items and the number of marks probably led early man to conceive the notion of quantity.

The Roman System

The tally system is very useful when counting a small number of items but when the number starts getting large e.g. the number of days in a year — the system becomes very awkward to use.

To simplify this task and others, the Romans invented a new number system. One characteristic that the Romans required the new system to possess was that it being more compact to write and also easier to read. They realised that to do so they would require more than one symbol. The additional symbols they introduced were V for five marks, X for ten, L for fifty, C for a hundred, D for five hundred, M for a thousand etc. They also devised a method for further abbreviation: a symbol signifying a lesser quantity to the left of another symbol meant less while, if it was placed to the right, it meant more. Thus VI means six, while IV means four; CXL means one hundred and forty, while CLX means one hundred and sixty, and so on.

This system obviously marks an improvement over the tally system: it is much more compact, it lends itself to writing large numbers with comparative ease and it does not sacrifice any of the qualities of the tally system — e.g. the uniqueness of representation. However, this system suffers from two major drawbacks: the first is that, for writing larger and larger numbers, we require more and more symbols if we are to preserve compactness. The second and more serious drawback is that this system does not lend itself to arithmetic manipulations — not even addition or subtraction.

The Arabic system

The Hindus around the 6th century A.D. devised a system based on positional notation, using a limited number of symbols; each symbol has a value which depends on its relative value to the other symbols (e.g. 3 is larger than 2 by 1 and 2 is larger than 1 by 1) and on its relative position within the number.

The Arabs copied the Hindu system and added zero to it, thus inventing the decimal system we are so familiar with.

The important thing that the Arabs gave to mathematics was the logical, consistent construction of a number system, but the number of symbols used and the shape of these symbols is completely arbitrary. The Babylonians, around 1700 BC, used a system utilising sixty different symbols. This system has its advantages and disadvantages as do many other systems that were and still are devised. Each scientific or commercial application adopts the base or radix (i.e. the number of symbols) that suits it best. We shall see some of these later on.

The positional system

The decimal number 4161 is said to be a four digit number: it contains four symbols (not necessarily different) in four different positions. The base of the decimal system is 10 and hence this number means 4x1000 + 1x100 + 6x10 + 1. Thus here the symbol 1 has two different values: 100 and 1. This number could also be written in the form of $4\times10^3 + 1\times10^2 + 6\times10^1 + 1\times10^0$. In general, a decimal number containing n digits could be written in the forms $a_{n-1}a_{n-2} \ldots a_1a_0$ where the a's signify its digits, or $a_{n-1}\times10^{n-1}+a_{n-2}\times10^{n-2}+ \ldots a_1\times10^1+a_0\times10^0$. To generalise, any positional system with base r would contain r different symbols 0 1 2 3 ... r-1 and could be written in the form $a_{n-1}\times r^{n-1}$

$+a_{n-2}xr^{n-2} \cdots a_1xr^2+a_0xr^0$ Here a_{n-1} is called the *most significant digit* (MSD) a_0 is called the *least significant digit* (LSD) r is the base or radix of the system and n is the number of digits in the number

The binary aystem

The binary system (r=2) has two different symbols 0 and 1 This system has a great advantage since most physical devices used by digital computers can distinguish between only two different states and each of these states can be represented by one of these two symbols For example a switch has two states off (0) and on (1) an indicator lamp has two states On (1) and off (0), a relay contact open (0) and closed (1) These examples can go on and on It is for this reason that the binary system is widely used in digital computers

The same type of *positional* notation is used in the binary system as in the decimal system, the rightmost digit is the LSD and the leftmost digit is the MSD

Table 1 Binary Counting

Decimal	Binary	Decimal	Binary
0	0	10	1010
1	1	11	1011
2	10	12	1100
3	11	13	1101
4	100	14	1110
5	101	15	1111
6	110	16	10000
7	111	17	10001
8	1000	18	10010
9	1001	19	10011

The largest digit value in the number is 1 (r 1=2-1)

Thus

0+0 = 0
0+1 = 1
1+0 = 1
1+1 = 10

In the last case (1+1) the sum is 0 with carry 1 to the next stage We shall later deal in further detail with binary arithmetic operations

Binary to decimal

From Table 1 we see that binary 10011 equals a decimal 19 We will use the formula for numbering systems to verify the truth of this statement

n=5 r=2 hence

$$N = a_4 x 2^4 + a_3 x 2^3 + a_2 x 2^2 + a_1 x 2^1 + a_0 x 2^0$$

Now $a_4=1$ $a_3=0$ $a_2=0$ $a_1=1$ $a_0=1$

Hence $N = 1x2^4 + 0x2^3 + 0x2^2 + 1x2^1 + 1x2^0 =$
$= 1x16 + 0x8 + 0x4 + 1x2 + 1x1 =$
$= 16 + 0 + 0 + 2 + 1 = 19$

A second and perhaps easier method for converting from binary to decimal is as follows we start from the leftmost non zero digit (or bit short for binary digit) and move rightwards by doubling the outcome and adding the next bit

Decimal to binary conversion

A simple scheme for converting a decimal number to its binary equivalent is by successive division of the decimal number by 2 and writing down the remainder after each division (it is worth noting that after dividing a number by 2 the remainder could be only 0 or 1) As an example let us take the number 19 and try to find its binary equivalent using this method.

19÷2 = 9 and remainder 1 – LSD
9÷2 = 4 " " 1
4÷2 = 2 " " 0
2÷2 = 1 " " 0
1÷2 = 0 " " 1 – MSD

Thus our number is 10011_2

The octal aystem

The octal number system has a base of 8 Eight different symbols are used to represent digits these are 0 1 2 3 4 5 6 and 7 Table 2 shows the first few octal numbers and their decimal equivalents

Table 2 Octal Counting

Octal	Decimal	Octal	Decimal
0	0	12	10
1	1	13	11
2	2	14	12
3	3	15	13
4	4	16	14
5	5	17	15
6	6	30	16
7	7	21	17
10	8	22	18
11	9	22	19

Since each position (digit) in an octal number consists of 1 of 8 different combinations 000 = 0 through 111 = 7 Thus octal to binary conversion is straightforward, replace each octal digit by its equivalent 3 bit binary pattern and you will get the binary equivalent of the octal number The reverse is also possible start from right to left grouping each three bits together and if required add some leading zeros to the binary numbers and then write the octal equivalent of each of these groups and you will end up with the octal equivalent of the binay number As an example

011 000 101 110 100

Thus because of the ease in converting binary to octal and vice versa and because the number of octal digits required to represent a number is much less cumbersome the octal system became very popular when the need to write binary numbers in Shorthand arose However this system is being used less and less today because of architectural changes in modern computers and this system is being superseded by the hexadecimal system which we shall discuss a little further on

Octal to Decimal Conversion

Using the formula for numbering systems the conversion is simple and straightforward We shall illustrate it by the above example 30564_8

Here n = 5, r = 8 and hence,

$N_{10} = 3x8^4 + 0x8^3 + 5x8^3 + 6x8^1 + 4x8^0 =$
$= 3x4096 + 0x512 + 5x64 + 6x8 + 4x1 =$
$= 12288 + 0 + 320 + 48 + 4 = 12660$

Decimal to Octal Conversion

Here we use the same scheme we used with the decimal to binary conversion successively divide by the number eight and write down the quotient For example $395_{10} = ?_8$

395÷8 = 49 and remainder 3 – LSD
49÷8 = 6 " " 1
6÷8 = 0 " " 6 – MSD

Thus $395_{10} = 613_8$

The Hexadecimal Syatem

The hexadecimal numbering system has a base of 16 Sixteen different symbols are used 0 through 9 A B C, D E and F Table 3 shows the first few hexadecimal numbers

Table 3 Hexadecimal Counting

Hex	Dec	Hex	Dec
0	0	B	11
1	1	C	12
2	2	D	13
3	3	E	14
4	4	F	15
5	5	10	16
6	6	11	17
7	7	12	18
8	8	13	19
9	9	14	20
A	10	15	21

The hexadecimal system is superseding the octal system as a means for abbreviating binary numbers for documentation purposes The treatment of hexadecimal numbers is very similar to octal numbers with two things to bear in mind The first is that since the number of symbols required exceeds 10 we must 'invent' six new symbols A B, C D E and F *We cannot* use their decimal equivalents 10, 11 12 13 14 and 15 respectively because each of these constitutes two digits The second thing to bear in mind is that when converting binary to hexadecimal or vice versa is that this time each four binary digits (bits) will make one hex digit The hex to decimal and decimal to hex conversions are very similar to the octal and decimal ones bearing in mind, in decimal to hex conversion that the remainder will range from O to F

LOGITEK

The ALTOS Sun Series ACS 8000 BUSINESS/SCIENTIFIC micro computer creates a new standard in quality and reliability in high technology micro computers

HIGH TECHNOLOGY

The ACS 8000 is a single board Z80 disc based micro computer It utilises the ultra reliable Shugart 8 inch IBM compatible disc drives double density – single sided and providing 1 M byte of data storage The ACS 8000 features the ultimate in high technology hardware a fast 4 MHz Z80 CPU 64 kilobytes of 16 K dynamic RAM 1 kilobyte of 2708 EPROM an AMD 9511 floating point processor (OPTIONAL) a Western Digital floppy disc controller a Z80 direct memory access (OPTIONAL) Z80 parallel and serial I/O (two serial RS232 ports 1 parallel port) and a Z80 CTC Programmable Counter/Timer (real time clock)

QUALITY SOFTWARE

Unlimited versatility The ACS 8000 supports the widely accepted CP/M disc operating system plus basic (Microsoft and C Basic) Cobol Pascal and Fortran IV All available now

Logitek in conjunction with its own microsoftware house Interface Software Ltd of Camberley is able to supply a wide range of proven 'off the shelf' business software including general accounting word processing stock control mailing list etc

There are already over 1000 micro computer installations using this software A track record which we consider speaks for itself

ALTOS

BUILT-IN RELIABILITY

The ACS 8000 is a true single board micro computer This makes it extremely reliable and maintainable The board and two Shugart drives are easily accessible and can be removed in less than ten minutes All electronics are socketed for quick replacement Complete diagnostic utility software for drives and memory is provided

Why 're-invent the wheel' when there is standard software of this quality available now?

If you are a dealer who may be interested in promoting the ALTOS and or Interface Software contact Logitek We can offer something rather special – now!

SUN-SERIES 8000

IN ESSENCE THE BEST IN INTEGRATED CIRCUIT TECHNOLOGY

LOGITEK

E I K Electronic Ltd
30 Kelvin Ave Hillington Industrial Estate Glasgow G52 4LH
Tel 041 882 1166/1661/1662 Telex 777255
Sales Enquiries to
Portland Street Chorley Lancs Tel Chorley 66803

BRAND NEWs

Issue Two

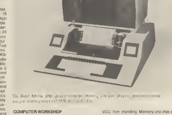
compiled by Microspy

This middle section may either be pulled out or photocopied than filed for reference It will be comprehensive and range over the whole field of products, services events and courses **PU** stands for Personal User **SB** stands for small base – that is small budget or small business **MB** – medium base medium budget or medium business **BB** – big base, big budget or big business Addresses are to be found at the end of **Brand News.**

Systems

APPLE II PLUS
6502 MPU Min of 16K bytes to 48K bytes Sound effects 40 x 48 colour graphics 15 colours callable by BASIC commands High resolution 280 x 192 graphics available Uses 8K RAM gives black white violet green Video monitor text 40 chs/line x 24 lines 5 x 7 dot matrix upper case characters normal inverted or flashing characters cursor control Typewriter style keyboard Fast cassette interface Disks available automatic invoking on power on Disks 118KB/diskette Write protection Data transfer 146Kbits/sec Up to 14 drives possible Random sequential file handling Up to 2 drives per controller Parallel printer card available interfaces to most printers Communications card available modem connectible BASIC commands High speed serial card to exchange data with computers printers Colour card Speech synthesis recognition hardware clock Also available 10M byte hard disk drive **Software** Business Ledgers Word processing Address mailing Information retrieval Stock Control Estate Agents management Available from NEWBEAR and other dealers **SB, MB**

BUTEL-COMCO
New Desk Top Computer Model Butel Athena DT/C8200 U S manufactured by Solid State Technology Inc Uses up to 11 microprocessors 8085 8-bit CPU based Other processors as intelligent controllers each with RAM ROM Direct Access for CRT display keyboard diskettes cassette tapes built in printer etc This leaves only scheduling and task management for the CPU as far as I/O is concerned *BASIC SYSTEM* Processor 8085A (3Mz standard 5MHz option) 2K RAM 12K ROM 12 levels of vectored interupts keyboard interface system bus interface alarm CCITT V34/28 and 20MA Currentloop interfaces modem control *Video controller* intelligent CRT controller chip 4K x 16 display/control RAM Total of 160 characters Keyboard Full ASC11 typewriter character set 15 key numeric pad 12 key editing 14 special function (8 programmable) N Key rollover Motherboard includes nine nondedicated logic module slots Power +5m +12 –12V AC line filtering *Options* Extended memory Line printer minicassette transports (1 or 2) up to 4 floppy disk drives up to 4 rigid disk drives all with dedicated controllers synchronous communications high speed network controllers modem *Standard software* AMOS (standard) multi tasking operating system **SB, MB**



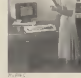
The Butel Athena 8?00 desk [illegible] [illegible] matrix printer [illegible] 1980 [illegible]

COMPUTER WORKSHOP
Two-Processor Systems 1) **Standard/09** Processor MC6809 16 bit instructions 16 bit internal data paths Maximum memory 56K bytes Up to 8 I/O devices such as printer and terminals can be attached 2) **Larger S/09** Processor MC6809 Max RAM 384K bytes Standard 128K bytes Up to 16 I/O devices Both systems with CT82 terminals microprocessor controlled Four types of Printer available Selectric 12/15 chs/sec Daisywheel 45 chs/sec Dot matrix 80 col Dot matrix 132 col **SB MB**

EQUINOX COMPUTER SYSTEMS
AUTO INDEX by Software House CAP CPP "A completely new concept in filing" Desk top micro + VDU + Printer + floppy disks Highly interactive Stock control Bureaus and employment agencies Mailing room Personnel records **SB**

CTS PRACTITIONER COMPUTER
See Applications

EURO-CALC
Model EuroC (Manufactured by Plessey)
Staff without computer knowledge can operate EuroC Software available Form appears on screen operation typed in Eight forms Sales invoices credit notes Purchase invoices credit notes nominal payments special entries Sales payments and discounts Purchase payments and discounts Nominal transfers Account updates Free-standing keyboard 15 fluorescent VDU free standing Memory and disk drives in module EuroC printer **Specs** 8080A MPU 64KB RAM 2x Double sides single density 8 floppy disk drives 1 Mbyte double density to come VDU 80 x 25 characters Full keyboard includes numeric key pad Tractor fed MATRIX Printer 140 characters p/sec 132 col wide Serial interfacing Operating system CP/M(tm) CBASIC (2) Can handle 1 000 accounts 12 000 transactions per month or more accounts fewer transactions (using single density floppies) **SB**



The EuroC

BRAND NEWs

JACOBS COMPUTER SYSTEMS
Based on HORIZON & IMS 8000 computers Fully integrated sales Purchase Nominal ledgers to Trial Balances Company reports Formatted input Sales Invoices Pay by supplier range or specific invoices Audit Trail control summaries Horizon configuration £4900 IMS 8000 configuration £6950 (excl VAT) **SB** (Horizon IMS 8000)

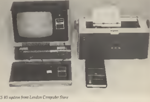
LOGITEK
ALTOS Systems Sun-Series 8000 Model ACS 8600 Single board Z80 based for "exacting requirements' of business and scientific laboratory markets Shugart double density disk drives Uses CP/M (TM) operating system 4 high level lang. Hardware Z80CPU, 4MHZ RAM 64K in 16K chunks ROM KB (2708 PROM) Separate from 64K user space for disk operating system Disks single sided/double density, 1M byte storage, floppy disk controller gives full set of disk commands & returns status enabling read/write whole track during one disk rotation, for Direct Memory Access (optional) Heavy duty power supply PIO for disk selection, Programmable baud rates, programmable real time clock High speed AMD9511 Floating Point Processor (Option) Software C/M (Option) CBASIC Microsoft MBASIC for CP/M interpreter 4 compiler FORTRAN IV (Compiler) PASCAL COBOL Macro assembler Business, word processing library — All immediately available Full hardware and software support Vendor states 'We know that one of the greatest constraints to the acceptance of microcomputers in commerce and industry is the failure of software development to keep pace with that of hardware " Vendor offers full library of proven programs Has own software house, Interface Software Ltd linked with American, Retail Sciences Inc. SB MB

LONDON COMPUTER STORE
WORDSTATION system based on TRS 80 microcomputer (level II) keyboard as in standard electric typewriters Display printers 3 types available high speed dot matrix IBM golfball daisywheel Text storage recall editing ALSO usable for business functions Stock control invoicing accountancy scientific Software available BASIC System spec TRS 80 level 11 (12K BASIC) Keyboard to separate numeric keypad 16K expandable to 48K Cassette of dual floppy storage Printers Anadex DP8000 dot matrix 1) IBM reconditioned golfball with nationwide service contract 2) Qume Sprint (New) daisywheel Prices start from £1195 Dual floppy disk drives business software in expanded version **PU SB (TRS 80)**

MICROSOLVE COMPUTER SERVICES
MICROSTAR Business Computer System Vendor states We have installed systems and provided services for clients in all areas of business and education MICROSTAR system uses Intel 8085 CPU 64K bytes standard **RAM** CP/M(tm) 3 RS232 ports power supply hard disk option integral dual floppy disk drives STARDOS Multiuser Operating system standard Update — Database Management & Report Writer Direct Sequential and Indexed Sequential File Access Software Sales Ledger 10 Standard Facilities Stock Control 5 Main Facilities Word Processing 9 Main Facilities Payroll — hourly weekly monthly 7 Main Features Microsolve also offers APPLE II/ITT 2020 systems floppy disk options All APPLE peripherals including Mountain Hardware APPLE Clock Speechlab voice recognition unit APPLE Light Pen APPLE Software includes Purchase Ledger Debtors Payroll Solicitors Accounting Financial Modelling Incomplete records Medical Billing/Case History Equipment Rental Schools Teaching Packages Stock Control Large range of Peripherals and Accessories — printers VDUs etc **SB MB** (MICROSTAR APPLE)

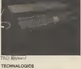
SEED
MSI 6800 range of Computers M6800 MPU 2MHz Modular SS50 Bus 16K to 56K Monitor MSIBug Boards Interface Adapter Motherboard and chassis EPROMS Power supply 5v DC 20amps Fully protected BUSINESS SYSTEM 32K bytes Floppy Disk system 10M byte fixed/removable Disk System SDOS Disk Operating System Dynamic File Allocation Interrupt Driven I/O Disk Sector Buffering Read Ahead System utilities can be written in BASIC DO FILE command enables system commands and tasks entered executed automatically SDOS supports multiuser BASIC Error handling addition of peripherals Optimises Disk Sector allocation Physical to logical sector mapping VDU and Centronics Printer Catalogue available **SB** (MSI 6800)

SHARP Electronics
Model MZ80K. Z80 CPU Built in clock 4K ROM Internal expansion to 48K 14K Extended BASIC in ROM 10 **VDU** 40 characters x 125 lines 80 x 50 resolution graphics 78 key ASC11 upper lower case graphics keyboard Cassette 1200 bits/sec 50 pin BUS connector for expansion to printers floppy disks (Drives now being developed by Digital Design & Development of London) To come Assembler Editor Loader Debugger **PU**



TRS 80 system from London Computer Store

TANDY TRS-80 Model II (Z80 MPU) Range
1) Model 26-40001 32K + 1Disk + Printer Printer 80 col
2) Model 26-1154 64K 1 built in disk external 2 disk drives line printer Up to 2 Mbyte storage Upper and lower case letters 76 keyboard Includes calculator key pad Two software programmable software function keys Level 111 BASIC Disk operating System use 24K RAM Self testing Director Memory Access 2 x RS232 C ports one Centronics (printer) parallel port. Future expansion through 4 plug in slots for optional PC boards Software Business software under development Software also available from independent vendors such as *London Computer Store* and *A. J. Harding (Molimerx)* **SB**



TEC Keyboard

TECHNALOGICS
TECS System TELETEXT/VIEWDATA computer/decoder 6800 mpu Up to 56K bytes dynamic memory Officially approved for PRESTEL connection Machine Code Monitor in ROM cassette or disk. Own TECs BUS structure TECs 8K BASK mini BASIC Expansion to floppy disks cassette I/O 9600 Baud

Teletext information can be stored recalled

VENTEK COMPUTERS
Vendor states one of the larger computer companies in Britain installed base of over 1700 machines Range of **VENTEK DATA POINT** Computers (A) 1500 Diskette Processor 32K user memory full function keyboard 1920 character screen highlighting Floppy disk unit, 1 or 2 drives (¼ Mbyte each) integral communications adaptor stand alone or concurrent operation **SB** (B) Datapoint 1600 60K user memory up to 4MB diskette store Stand alone or in distributed system **SB MB** (C) 120K user memory 960 character screen full keyboard 2 cassette drives Disk units up to 200MB up to 24 VDUs supported Wide range of peri

pherals communications equipment **MB, BB** **Ventek Software** Operating systems utilities languages communications applications packages Languages offered COBOL, RPG 11 BASIC Own Datapoint DATABUS high level business processing language Communications software emulators for IBM ICL Burroughs Honeywell Control Data Sperry Univac Teletype Applications packages Accounting business estate agents **MB BB**

Applications

THE BRISTOL SOFTWARE FACTORY
TRADER software packages for the PET Vendor claims These packages really are a quantum leap forward Error proofed TRADER first package on offer 'Totally integrated stock control invoicing sales ledger Handles up to 4 400 stock items and accounts simultaneously Totally interactive Updates VAT discounts gross profit invoices credit notes stock reports for stock valuation stock levels outstanding orders Current status of sales accounts Dual drive PET handles 2 200 stock items & sales accounts Quad drive handles 4 400 items Standard stationery supplied Demonstrations arranged DEALER enquiries invited **SB** (PET)

BUNZL DATA SYSTEMS
Financial Modelling System FINAR Clients include Newsweek magazine For sales analyses projections For managers with little computer experience to write their own models budgetary planning management accounting investment appraisal Vendor states Cost-effective Total Newsweek budget in first year operation no more than £5 000 On BUNZL range but seperately purchasable to run on DEC PDP11 System handles multidivisional/multiproduct groups exception reporting sensitivity analysis DCF calculations moving average totals interpolation & extrapolation line plots histograms or bar charts (DEC) **MB**

BUTEL BUSINESS SYSTEMS
Mini computer Financial Modelling Package IMPACT Interactive easily understood instructions English-type Enables construction of models of plans budgets cashflow analysis investment evaluation Easy modification of models **MB** (Data General NOVA Eclipse Series)

CTS GROUP
Systems and Software for Accounting Practitioners By accountants for accountants Group in being since 1968 Marketing Installation Liaison and Program support divisions Main facilities *Accounts* and *Finalisation* providing for total requirement of practitioner s needs *Admin* for administration of practice *Statcon* allows statutory facilities provided by practitioner to be carried out *Tacs* aid for recording dealing with tax assessments payments BUREAU SERVICE exceptionally low cost Facilities above also offered with PRACTITIONER Computer for inhouse use (excludes Statcon) — Other facilities with the Practitioner system Time Recording includes control of fee ledger Client status includes work-in progress status report Internal accounting for practitioner s own business Payroll package that practitioner can in turn offer clients System based on ICL 10 processes data passed on from client accounts prepared by staff gives first draft of accounts then final set of output reports Accounts are then finalised accounts and reports printed Excellent Catalogue available **SB MB** (using BUREAU service) **MB BB** (purchasing Practitioner Computer) (ICL)

INTEX DATALOG
Weekly payroll system Up to 200 employees Weekly wage slips summary of payments deductions cash analysis monthly payments deductions summary Tax and National insurance including additions amendments contracted out employees Wage rates normal half or double time Holiday sick pay Backdating £50 with manual Update service for packets £10 **SB** (PET)

LANDSLER SOFTWARE
Payroll for 32K PET and Commodore Disk "Very User Friendly" Vendor claims this to be program by which all others will be judged' All tax codes. ALL NI codes Hourly, weekly monthly paid staff all on same disk file 3 overtime rates 5 pretax adjustments 5 aftertax adjustments Cash analysis Separate total for cheque payments Payslip and copy printed side by side Prints totals to date Prints shows employee details Employee file details alterable Updating service SB (PET)

MEGAPALM
Specialists in systems analysis configurations for first time user Programs packaged or bespoke Service includes micros for schools colleges university departments Software supplied under licence includes staff training Hardware and software maintenance available Disk based invoicing and sales ledger systems data & transaction analysis scientific programs statistics management information tax Commodore approved **SB** (PET)

SOFTECH (Dublin)
Software for APPLE integrated business programs Comprehensive set of files Add amend product records and accounts Invoicing Cash receipts Debit/credit memos Invoice adjustment. Bad debt Valid transactions report Prints Aged analyses of debtors Master accounts file product file Invoices VAT analysis Sales analysis Stock recording Controls for accuracy Error checking of inputs Complete documentation Sample system capacity for 800 accounts 270 products 2 data discs handle 3 030 transactions **SB** (APPLE)

STATE ONE COMPUTERS
PETAL database software for PET Facilities create files screen displays search and print based on flexible formats and search criteria relevant to stock records personnel patient and client records £130 exc VAT Other packages due within year — will allow random access indexed access transaction handling Commodore approved **SB** (PET)

VENTEK COMPUTERS
See Systems

WOOTTON JEFFREYS & PARTNERS
MACCS Membership Accounting System Minicomputer based Add amend delete membership details Membership enquiries Payment of subscriptions for membership & periodicals Direct payments refunds journals — direct debits handled Adjusts for suspense accounts wrong members accounts Management reports Detailed analysis of membership transactions Flags guard against double invoicing Invoices generated year-end procedures implemented Company states over 50 highly qualified professionals employed **MB, SB**

DATA SCIENCES INTERNATIONAL
REMPAC *multiple retailers* Management Package For all sizes of retailers from clothing to camping equipment multiple retailing **Input of information** 1) For small retailer copies of sales sheets warehouse despatch notes returns etc sent to DSI Computer Centre processed 2) Retailers using Kimball tags send detached portion to Centre Information then processed 3) High volume low value merchandise information garnered from frequent stock takes **File Processing** Product description VAT rate product type supplier cost and selling price other relevant details together with opening stock integrated into data base of weekly product sales orders on suppliers branch (if any) stocks sales & purchase history profitability User may specify reports required Nine standard reports available include above and also Warehouse picking lists allows stock issue to branches Open to Buy compares cumulative purchases with budget Line Performance compares expected performance of stock turnover sales rates etc with actual and prints exception reports of above or below expectations Budget accounts BUREAU service **SB MB BB**

GAMMA
Retailpac for retail newsagents Enables publication updating price changes done by head office or local wholesaler Monitors home deliveries and call orders prints delivery lists automatically charges customers logs titles & quantities Dealer amendments coded onto forms sent weekly to a control point for entry to the computer system Complete delivery lists for each round showing morning evening Sunday publications Lists of order to be collected in shop Summary of each delivery round number of deliveries number of publications per category Total copies delivered & collected daily printed out. Weekly invoices current & amount owing new balance carried forward Invoice summaries Bureau based (DEC PDP11) **MB BB**

GREAT NORTHERN COMPUTER SERVICES
Software Packages For most Z80 & 8080 based systems Simple robust reliable Fully documented Ledger packages Nominal sales purchase payroll Stock control for retailers etc End user prices £275 Integrated Business system package £985 Range of packages for APPLE under development Immediately available Inventory statistics video message system for APPLE Packages in CBASIC Cromemco Extended BASIC North Star BASIC Source code and user manuals fulltime enquiry answering service **SB** DEALER enquiries invited (APPLE Cromemco)

BRAND NEWs

INDATA
FLAIR system for Clothing and Footwear Retailers No previous computer systems experience required Stock control and management Indata supplies customers with Decision Data cardpunch machine for warehouse Cards punched for suppliers deliveries attached to individual items giving details of style number colour price size etc Cards in three parts first collected from warehouse updates stock holding Second collected from branches updates stock holding at branches Third remains on retailed item Information from cards enables management reports on weekly basis sales achievement movement factors overall financial position Extra facilities available include purchase order monitoring purchase ledger Five main management reports weekly sales performance weekly control branch by branch and overall company trading by product group Monthly sales/stock report Monthly analysis of suppliers reports branch breakdown (a financial report) Weekly distribution list (optional) Vendor claims No-nonsense approach to stock control problems offers an extremely flexible and very low-cost solution From £700 yearly BUREAU SERVICE **MB BB**

Disks, Tepss, Punchee, Reeders

AMPEX
DISK STORAGE MODULES Standard features SMD compatible interface In Line Heads 5-high disk packs NRZ to Miller Code (MFM) data encoding PLO/Data separator variable sector format address mark capability On track head serving removable address plug 1 209 Mbytes/Sec transfer rate 28ms average access Track capacity 20 160 bytes Cylinder capacity 100800 bytes Dynamic braking DC power supply single port daisychain interface power sequencing Models DM 940 40MB DM 980 80MB DM 9160 160 Mbytes **OEMS BB**

CPU PERIPHERALS
8 inch Winchester technology FIXED disk drive series the SA1000 The series offer 5 and 10 megabytes capacity at a very low cost per Mbyte Has the same physical dimensions and environmental specifications as the standard 8-inch floppy drive Vendor claims Greatly improved performance and cost from faster access time increased capacity and overall jump in throughput **MB BB OEMS**

CENTURY DATA SYSTEMS
MARKSMAN Models M10 M20 M40 RIGID DISK DRIVES Capacity Bytes per drive 10 08M 20 16M 40 32M respectively Bytes per track 24 000 for all 3 models Tracks per cylinder 2 4 8 respectively Bytes per cylinder 48 000 96 000 Cylinders 210 for all three Transfer rate 960K bytes/sec Access Time 3ms single track 43ms average 113ms max 17ms Head settling time 12 5ms average latency 12 5ms Error rate Recoverable 1 in 10^{10} bits Non recoverable 1 in 10^{13} bits Positioning 1 in 10^6 seeks MTBF (Mean time between failures) greater than 8000 hrs MTTR (Mean time to replace) less than 30 mins 8 x 18½ x 21½ inches 45lb Vendor claims Represents a breakthrough in cost-performance Winchester Technology **OEMS**

CENTURY DATA SYSTEMS Hunter family of fixed and removable media drives with capacities of up to 100 megabytes now in production 3330 technology fixed and removable media or split pack drive Three models One two or three fixed disks for 16 50 or 80MB with another 16MB on a removable 5440 type cartridge Average access time 9 37Ms Enclosed contamination control system Hunter disks 833 cylinders with 6060 BPI & 20160 bytes per track Hard or soft sectoring Micro processor monitoring of status and faults Prices in OEM quantities $3900 $4900 and $5850 for the H32 H64 and H96 (numbers refer to Mbytes) for single access units Cartridge prices in OEM quantities under $100 **OEMS**

COMART
1) Tandon MINIFLOPPY Diskette Drive Industry compatible Double sides over 350K bytes high stepping speed 2) WINCHESTER Technology IMI 7710 11 Mbyte Drive a compact packaging a new era of data storage technology 2 x 200mm diameter disks r/w heads in a closed-loop micron filter air system 350 tracks per surface at over 5800 BPI data transfer 648K bytes/second Minimum access 10ms Average access 50ms Latency 8 3ms Disk speed 3600rpm ± 1% **OEMS MB**

MICROCENTRE
IMI 7710 11 Mbyte Disk Drive with Z2H system See Comart

CONTROL DATA CORPORATION
Model CDC 9404B Eight inch flexible DISK DRIVE Some features Single density 4 million byte double 8 million bytes IBM compatible Available with modified ANSI 50 Pin board edge connector Industry compatible power connector Compatible with diskettes written on IBM 3540 3740 and system 32 equipment **OEMS** (IBM)

MFE LIMITED
Flexible Disk Drives 700 Series — Double Sided 500 Series — Single Sided Model 700 AC Motor Soft Sector 701 AC Motor Hard Sector 750 DC Motor Soft Sector 501 AC Motor Hard Sector 550 DC Motor Soft Sector 551 DC Motor Hard Sector Capacity *Double sided/double density* Unformatted per diskette 1 6 Mbytes per track 10K bytes *Double sided/single density* Unformatted per diskette 800K bytes per track 5K bytes *Single sided/single densigy* Unformatted per diskette 400K bytes per track 5K bytes Format IBM compatible Transfer rate 250K bits/sec single density 500K bits/sec double density (both nominal) Track density 48 tracks/in Access 3ms track to track Rotational speed 360rpm + 1 5% Helical band drive Media IBM 3740/3600 diskette or MFE equivalent. 77 tracks 2 read/write heads Read error (soft) less than 1 x 10^9 bits hard less than 1 x 10^{12} bits Positioning error less than 1 x 10^6 AC and DC models Options 7 factory installed 21 customer installed **OEMS MB BB** (IBM)

MIDLECTRON LTD
M62 reader punch unit Can link telex machines to word processors Interfaces to standard ASCII code produces paper tape input compatible to other codes Panel of touch sensitive keys switchable baud rate full or half duplex operation Vendor claims M62 being considered for a design award as sential part of the office of the future **SB MB**

SYSTEMS INDUSTRIES
MIDAS 9400 (Microprogrammed Intelligent Disk Access System) now in the Supreme Headquarters Allied Forces in Europe at the Hague MIDAS second generation microprocessor-based emulation disk controller for a maximum of 8 x 67 or 256 MB disk drives on the DEC PDP11 (11/70 or VAX 11/780) series Can be shared with up to 4 x PDP 11 CPUs **Standard MIDAS Configuration** 1 8 interfaces for CDC (Control Data Corporation) 67 or 256 Mbyte Storage module disk drives 2K byte data buffer to eliminate timing errors Error correction code to remove media errors Multiple Sector Transfer — single command transfers up to 560K bytes Standard also full set of microprocessor diagnostics complete emulation package for DEC systems no change to DEC operating systems software **BB MB** (DEC) (CDC)

The [illegible]

Processor & Memory Boards, Chips, Programmers, Test Instruments, Modulse, Training Aids

BFI ELECTRONICS
The AQ8080Z Microprocessor Analyzer diagnostic instrument using in circuit testing techniques Via a buffered probe clips on to microprocessor packages provides detailed test and indication of logic levels subsystem performance and overall dynamic performance

CONTINENTAL SPECIALTIES CORPORATION
Proto-Beard 203A High capacity solderless breadboard includes three built in power supplies For designing directly in hardware assuring proper circuit operation before drafting a formal circuit diagram 2250 nickel-silver contacts Accepts any DIL configuration as well as all discrete components typical capacity up to twenty-four 14 pin DIPs 10 distribution bus bars plus four 5 way binding posts and aluminium ground plane base Built-in power supplies include a 1% regulated at 5+ 25 volts rated at 1 full amp 10 millivolts combined ripple and noise at ¹ amp out Also has separate +15 VDC and 15 VDC 5 amp supplies each of which can be internally and independently adjusted over a 7 18 volt range Housed in 2 5 kilo package 248 x 168 x 83mm represents the ultimate in Bread boards for Circuit Designers Vendor states **PU, SB, TTL Designers**

[illegible]

CONTINENTAL SPECIALTIES CORPORATION
The Digital Pulser – DP-1 Circuit powered unit injects signals at key points to test digital circuits with fast stimulus – response troubleshooting techniques Automatically senses the circuit s condition (high or low state) delivers a single clean bounce-free opposite polarity pulse of the proper level **Features** Pushbutton control allows single pulses or train of pulses (100 pulses per second) LED indicator signals one-shot or continuous pulse mode Takes power from circuit so pulse voltages compatible with levels of logic system Can be connected indefinitely — presenting a 300 000 Ohm impedance to the

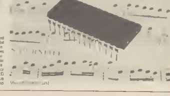
BRAND NEWs

circuit under test Fully protected against output short circuiting Overvoltage protected to 25 volts Reverse voltage protected at the supply leads against up to 50 volts Slide switch selects either CMOS/HTL or TTL/DTL logic families £51 00 **SB MB**

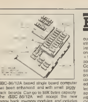
GENERAL INSTRUMENT MICROELECTRONICS (GIM)
New single chip *tunes synthesizer Model* AY 3-1350 programmable to generate up to 28 different tunes The 28 lead N MOS device uses single 5v power supply is suitable for use in toys musical boxes doorchimes Chip is based on standard GIM microcomputer circuit normally mask programmed during manufacture Standard circuit preprogrammed with 25 short tunes plus 3 simple chimes may be altered to suit application Possible to program just a single tune consisting of up to 251 notes Chip can also generate tunes from data held in external PROMS so OEMs could plug in different tune sets **OEMS**

INTEL
New 1 megabit bubble memory board Model IMB 100 for use with Intellec Series II development systems and with any system employing the intel MULTIBUS Employs the 7110 megabit bubble memory device Fully compatible with MULTIBUS systems can be used with ISIS II operating system resident in the Intellec Development System A 8085A cpu on bubble memory board used as a memory controller The cpu in development system communicates with this memory controller via a set of registers using normal I/O commands The 8085A controls system timing and various analogue circuits necessary to access the bubble memory Data exchange achieved using either a FIFO on the board or I/O commands Set of test programs are supplied on a double-density floppy disk (single density disk optional) for exercising the memory Programs for transfer of data between internal RAM buffer and either standard ISIS II device and file or the bubble memory also included No software licence required for IMB-100 Storage capacity of IMB 100 exceeds that of single-density mini floppy disk by substantial margin The **7110** bubble memory module Compact non-volatile mass storage device normal data capacity 128K bytes Data stored as magnetic bubbles in a very thin film of synthetic garnet Each bubble is a few microns in size Presence of a bubble represents binary 1 absence a binary 0 IM7110 organized as a serial—in parallel loop serial out shift register Data is read in a unique manner A bubble from a loop is replicated (duplicated) one of the two bubbles continues around the loop to preserve the memory while the other proceeds along the output track to the detector High stability achieved with pair of permanent magnets enclosed in metal case of shielding material Device can be used near CRT coils transformers and other electromagnetic equipment 7110 bubble memory employs 256 storage loops to hold a megabit of data Has 64 additional loops Sixteen for an error correction code the other 48 redundant loops may be defective without affecting chip usefulness An independent loop called the Boot Loop identifies good and spare loops contains a loop map Can be operated in temperatures from 0°C to +50°C requires +12 Volt and +5V DC power supplies **SB MB OEMS System Designers**

INTEL
16-bit *single-board* Computer with 96K bytes of Memory Model SBC-86/12A. The



[illegible] GIM



iSBC-86/12A based single board computer has been enhanced and with small piggy back boards Can go to 38K bytes capacity The iSBC 86/12A will accept the new piggy back memory modules and includes full Multimaster expansion logic functions which are performed by an 8289 mounted on the board This eliminates the need for a piggy-back BUS exchange module The new memory piggy back boards are the iSBC-300 32K byte MULTIMODULE RAM and the iSBC-340 16K byte MULTIMODULE EPROM With both memory expansion MULTIMODULES in place the iSBC-86/12A occupies only one card slot in a MULTIBUS card cage provided it is an end slot The use of 'piggy-back memory with iSBC 86/12A is superior in operating speed and power consumption to normal iSBC memory expansion boards The iSBC-86/12A no longer has to wait for access to the MULTIBUS a saving of at least three wait states per transfer **OEMS, SB BB**

INTEL

HYBRID MICRO Innovation *2920 analogue* Signal processor Vendor claims Major step forward in both analogue and microcomputer technology 2920 is an analogue-in analogue — out micro function determined by SOFTWARE. circuit development entails writing debugging programs using INTELLEC development system 2920 Features D to A A to D converters high speed 25 bit digital processor EPROM small scratch pad RAM *2920* 4 analogue inputs eight analogue outputs Functions Analogue input signals (0-10KHz) converted to digital format processed under program control reconverted into analogue for output *Support package* for 2920 is the SP 20 comprises 2020 assembler and software simulator on floppy disc operating with the INTELLEC development system Simulator entirely software Typical applications of 2020 lowpass & bandpass filters up to 20 complex pile and/or zero pairs threshold detectors limiters rectifiers up to 25 bit multiplication/division approximations to nonlinear functions waveform generators **SB MB OEMS**

INTEREP S.A.

Data TEST SET Model 1R-Datacom Tester Portable Low cost. LSI based design. Prevents bit errors distortion turn around time Asynchronous operation up to 19 200 bps Synchronous up to 100 000 bps CCITT ISO Specs Monitors modem interface Selftest **SB Engineers**

MICRODIGITAL

Reed relay board for NASCOM 1 (£49 95 + VAT) 16 Reed Relays totally isolated 200mA, 50 VDC 5W max each Operate and release time 1ms (including bounce) Single sided glass fibre board gold plated edge connectors silk screened component layout Plugs directly into NASBUS does not interfere with normal NASCOM operation all interrupt and DMA Daisy Chain Links carried on Draws 250mA from each of the +5 and +12V Rails All components supplied all ICs socketed program in BASIC or Machine Code Occupies 2 consecutive ports link selectable — several boards can be used on one NASCOM System Output is front edge connector on 0 1 centres Uses standard edge connectors for connection to controlled devices Complete manual with sample software types of application (light displays model railway control etc) **PU SB** (NASCOM 1)

MICROSYSTEM SERVICES

EPROM Erasers Model Numbers 154 100 UV Erasers Spec Operating voltage 230v 50Hz or 115v 60Hzz Power 100 watts max, Erasure time presel up to 40 mins UV Source wavelength 253 7nm UV intensity (nominal) 6 00mw/cm^2 Recommended bulb life 2 000 hours PROM Capacity Model 100 104 PROMs Model 15 15 PROMs Board erasing area 240 x 240mm (9½ x 9½ ins) **OEMS, SB MB** See Literature

PORTABLE MICROSYSTEMS

Electronic Logic Trainer ELT 100 For tyros Small portable Teaches all gates flip-flops switch circuits V diagrams Binary and Binary Coded Decimal (BCD) counting Input through switches output liquid crystal display (LCD) Problem cards One-off £59 95 Discount for quantities **PU Engineers**

RAPID RECALL

Add-on general purpose MEMORY system SERIES 90 Models Expands existing systems or allows combination of static dynamic RAM technologies Products in this SERIES-90 include memory bus control interface modules static dynamic memory modules Incorporates new bus BXP bus 24 address lines 4 module (up to 16) word sizes possible 16-60 bits with error connection code Memory products available Static memory modules cycle times as fast as 100nsec dynamic memory modules cycle times as fast as 350nsec Memory systems transfer rate up to 80 Mbytes per sec with byte addressing error correction 110 Mbytes without synchronous OEMS

1R Datacom Tester

RAPID RECALL

New 2K x 8-bit bipolar PROM Model 3636 (three state output) Typical power dissipation o 5mW/bit Maximum access time 8ns over the 0°C to + 70°C temperature range faster version (3636 1) available maximum access time of 65ns over same temperature range Power supply tolerance =±10% the same specs Housed in a standard 24 pin package Schottky clamped TTL technology with polycrystalline fuses Three chip selects minimum amount of bank select logic necessary in large memory systems

RAPID RECALL

New I/O processor chip *Model 8089* Can be employed with both 8-bit and 16-bit microprocessors to relieve the cpu in the system from routine peripheral handling and data formatting tasks A microprocessor in its own right, instruction set optimized for I/O handling Shares memory other system resources with the cpu or can operate as totally independent processor own local memory 8089 connects to main system bus Two way communication between the cpu and the 8089 employs a high level protocol and mail box locations Data for the 8089 is written into a segment of memory allocated for I/O transfers where it is directly read by the 8089 DMA facilities transfers from memory to output from input to output, one port to another Transfers can be terminated as a result of byte count, an external termination signal as it a mask and compare test either passes or fails or on any combination of these Data can be translated on-the-fly during data transfers using a 256 byte lookup table that can be situated in either system or local memory Bandwidth of 8089 is 830K bits/sec for an 8 bit bus 1 250K bits/sec for a 16-bit bus Reduces cpu wait time to less than 1% Vendor states **SB MB**

RAPID RECALL

CMOS EPROM programmer Model 6920 for Intersil IM 6653/54 family of CMOS EPROMS and for IM87/C41 family of CMOS EPROM based 8-bit single chip microcomputers Usable in three modes stand alone for duplication of EPROMS master for operation with remote terminals slave to software development system or minicomputer 6920 is microprocessor controlled 16K internal buffer LED Status indicators RS232C interface standard for both serial I/O ports 20MA Current loop through strapping of TERMINAL port (for master mode) COMPUTER port used for slave mode Transmission switch selectable 50-9600 baud in 13 steps **SB MB OEMS**

SMALL SYSTEMS ENGINEERING
(Subsidiary of Abacus Computers)

STUNT BOX interface connects nearly everything to everything Based on 8085 micro PROMs store control routines 32 bits I/O up to 2 synchronous 3 asynchronous ports BASIC Stunt Box buffers up to 240 bytes of data (plug in cards for up to 16K bytes) Software now available IEEE 4 serial bidirectional IBM 3270 to RS 232 asynchronous Variety of parallel to parallel protocols Programmable baud rates synch or asynch Control routines in high level languages such as BASIC can be resident in Stunt Box so can be used as a computing controller Basic Model C300 **MB OEMS**

U-MICROCOMPUTERS
Model SCP100 16 bit 8086 CPU S100 Bus board To proposed S100 IEEE spec 1 Mbyte addressing range Usable with mixed 8-bit 16-bit RAMs & other peripherals 4MHz clock,4MHz upgradable to 8MHz Support card also available with 2K monitor disk bootstrap serial port software select baud rate 8086 BASIC from Microsoft CP/M(tm) available **PU, SB, OEMS**

A short note on the 8086 processor
Eight 16-bit general purpose registers Any register usable as an accumulator 6 byte instruction prefetch queue allows overlap of instruction fetch & execution 256 interrupt vectors 4MHz operable at 8MHz Register to register move time 250nsec at 8MHZ.

MOS EPROMs — Hints and Tips
One of the most common causes of failure of equipment containing MOS EPROMs in the field can be traced to PROM devices that were not properly erased before programming Such faults can be very difficult to trace particularly under field conditions The solution is obvious make sure that high-quality erasers are employed Make sure that the PROMs are exposed to the UV radiation for the right amount of time

EPROMs are erased by placing them approximately one inch from a source of high intensity 254nm (UV) radiation The amount of time required for erasure is specified in terms of minimum integrated dosage expressed in W-sec/cm^2 and is a function of the power rating of the UV source

As the UV source ages its intensity diminishes which means that an EPROM left to erase for the usual time may not be completely erased if the tube is old Incomplete erasure can cause increased access time or unstable bits which can switch a considerable length of time after programming Periodically check your UV source by the following procedure illustrated in the drawing * Place a programmed EPROM under the UV source for a measured short period of time * Put the EPROM in the programmer and check to see if it is blank * If it is not blank put it under the source again for another mesured period Repeat steps 2 and 3 until the PROM is blank * Multiply time-to-blank by 3 and use this figure as a minimum for an erase time

Use caution with UV sources and avoid unnecessary exposure Radiation of the recommended intensity can cause burns and damage to vision Finally guard against unwanted erasure of an EPROM after programming by covering its quartz lid with a UV filtering label material

Handling MOS PROMs
MOS PROMs are susceptible to static discharge which can ruin sensitive oxide layers within the device Use the following precautions when handling MOS PROMs * The conductive plastic or metal carriers are especially designed to protect MOS PROMs Use the carriers whenever possible * Ground all equipment in work area * Use conductive foam on work surfaces • Ground soldering iron tips * Discharge yourself by touching ground before handling devices * Carpet if necessary should be of synthetic material not wool Carpet sprays can be used to minimize static electricity

(WARNING Short wavelength UV is injurious to the eyes and can cause permanent damage Ensure that the unit is disconnected from the mains before dismantling This information is extracted from a MICROSYSTEM SERVICES brochure See Literature)

BRAND NEWs

Bureaus, Consultancies, Services, Shops

ACT (Applied Computer Techniques), incorporating PETSOFT
"Everything for the Commodore PET" ACT is a software house established 1966, now offering software for micros inhouse programmers Full range of Sales Purchase accounting Print out PET with disks or cassette Cassette system Business packages £225 + VAT Disk Business packages £350 + VAT ACT also supply hardware with either COMMODORE or COMPU/THINK Disk systems

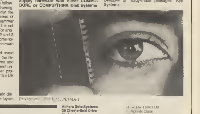
ALSO Programmers Tool Kit, machine language program in 2KB ROM Plugs into PET gives 10 new BASIC commands AUTO (New Line numbers) RENUMBER, DELETE APPEND (adds previous saved program to current one) DUMP (displays names, values of variables), HELP (Error detection) TRACE (STEP) (line by line program execution) OFF (turns TRACE or STEP off) Plug-in version for new 16K 32K PETS £55 + VAT SB (PET)
Stop Press Price reductions on big range of software

THE BYTE SHOP (London Ilford Birmingham Nottingham Manchester Glasgow)
Excellent catalogues extensive range of systems Business software Purchase Nominal and general ledgers Order and sales processing Payroll Tour Operator (Holiday booking system) Property Management Insurance Booking CP/M(tm) for Z80 systems (SOL North Star Horizon Cromemco ITT 2020 Ohio Scientific C2SP and C3-B SWTP 6800 range PET NASCOM1 KIM1 Ohio Superboard S100 cards printers VDUs) **PU SB MB, BB**

ENSIGN
Business software hardware disks stationery for small computer users Agents for *Grama Winter* (Own configuration APPLE II ITT 2020 PET) **SB**

HB COMPUTERS
Business software Entertainment programs PET systems including floppies Word processing package APPLE II with add-ons **PU SB** (PET APPLE)

MICROSOLVE COMPUTER SERVICES
Consultancy house analyses business requirements especially for first-time users Bespoke or ready-made packages See Systems


Programmers Toolkit by PETSOFT

Address Bus

Almarc Data Systems
29 Chesterfield Drive
Burton Joyce
Nottingham Tel 0602 248566

Ampex Great Britain Ltd
Acre Road
Reading
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Tx 847611 Tel (0734) [illegible]

BF Electronics Ltd
516 Walton Road
West Molesey
Surrey
KT8 0QF
Tx [illegible] Tel 01 941 4066

B[illegible] Electronics Ltd
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Wokingham
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The Bristol Software Factory
Micro House
St Michael's Hill
Bristol
BS2 8BS Tel 0272 20801

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Hockliffe Street
Leighton Buzzard
Beds
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Tlx Micro 83137 Tel 0280 702017

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Wooburn Industrial Park
Wooburn Green
Bucks
Tlx 849439
Tel 062 85 219[illegible] 27072[illegible]

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Nantwich
Cheshire
CW5 5LJ Tel [illegible] 27[illegible] 60[illegible]1

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London
S W 18 Tel 01 87 4805

SEED (Strumech Engineering Electronic Developments)
Coppice Side
Brownhills
Walsall
West Midlands
Tel 05433-279 4221

Sutech Ltd
17 Knock[illegible] Park
Templeogue
Dublin 16 Tel 3 62[illegible]

System Industries Europe
System House
Guildford Road
Woking
Surrey Tel 04862 60[illegible]

Tandy Corporation
Bilston Road
Wednesbury
West Midlands
(Tandy branches all over UK)

Technalo[illegible] Ltd
8 Egerton Street
[illegible]

Tektronix UK Ltd
PO Box 69
Coldharbour Lane
Harpenden
Herts Tel Harpenden 63141

U Microcomputers Ltd
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Cheshire
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Tlx 666592 Tel [illegible]

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Tlx 923003 Tel 01 452 5111
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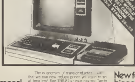
MACRO SALES BRING MICRO PRICES TO TRS~80 MICROCOMPUTER

TRS-80 is fully wired and tested—NOT a Kit

Designed and manufactured by TANDY CORPORATION

'Level' refers to version of BASIC programming language offered by a particular version


STAR OF THE PERSONAL COMPUTER WORLD SHOW, WEST CENTRE HOTEL, LONDON
NOV 1st—3rd, STAND 26—28

K factor relates to size of Random Access Memory and degree of program and data storage a particular system offers

TRS-80 is a modular system capable of expansion to suit your needs exactly. Get details of 'expansion interfaces' upgrades and system capabilities from your local TANDY store

Mass production following phenomenal world wide sales brings prices tumbling again.

Within [illegible] years of introduction world wide sales of the [illegible] TRS-80 microcomputer have soared [illegible] the [illegible] figure mark—Thousands upon thousands are now in use in businesses, schools, laboratories, universities and homes performing a multitude of useful functions from teaching ten year olds to financial analysis. Anyone can learn to use TRS-80. The system is modular and can be extended as your knowledge and requirements increase. For the price of a good typewriter you can become part of the silicon-chip age. TRS-80 is the worlds biggest selling microcomputer, designed, manufactured and sold by Tandy Corporation.

The economies of mass-production mean that we can now reduce prices yet again to an all time low! See TRS-80 at your nearest Tandy store today and discover what it can do for you.

NEW LOW PRICES 4K LEVEL I £335

4K LEVEL I	£385.25	£335.00
4K LEVEL II	£469.20	£408.00
16K LEVEL I	£485.15	£421.87
16K LEVEL II	£546.25	£475.00

Please send me full details of the TRS-80 microcomputer system plus location of my nearest TANDY store

I am interested in TRS-80 ☐ TRS-80 MODEL II ☐

NAME

ADDRESS

PHONE

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TANDY

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Offers subject to availability. Instant credit available in most cases.

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WHITHER INMOS – AND WHY BOTHER?

Delving into the Inmost Secrets of Inmos

The plane rocks and rolls in the updraughts as it dips over the foothills of the Rocky Mountains and lines up on final approach to the runway at Colorado Springs Airport Rocky Mountain Airways is running late, we were nearly two hours late leaving Denver and by the time we have pulled up on the ramp and got into the terminal it is nigh-on 11 30 p m which is a shame Colorado Airport shuts down at 10 30 and the place is deserted

Getting a cab proves almost impossible and involves another half hour waiting for it to drive out from the town Eventually, I am ensconced in a motel room just across the road from my target for the next day

That target is Inmos which has chosen this apparently sleepy town in Colorado State in the US to establish a technology centre to develop its semiconductor processing capability It is far away from the madding crowd of speculators hecklers and well wishers the company has picked up in the UK since it was first launched on an unsuspecting public in the middle of 1978 by a well timed but poorly researched leak in the *New Statesman* magazine

> *'Inmos, since that time, has become one of the biggest political hot potatoes that modern technology has ever managed to cultivate '*

Inmos since that time has become one of the biggest political hot potatoes that modern technology has ever managed to cultivate Its announcement, both unofficial and official followed closely on moves by the then Labour Government to support both the existing UK semiconductor industry and the application of microprocessors and microelectronics in industry in general

These moves alone had created considerable political wrangling as to whether they were necessary Now suddenly, the National Enterprise Board a basically autonomous but Government-backed operation had jumped in with an initial £25 million to start an entirely new microelectronics company aimed squarely at taking on and beating the best in the world

That news was met, by and large, with various levels of hysteria especially from people who little understood the machinations of the semiconductor business For example it was discovered that the 64K bit RAM was to be the company s first product yet it would not be available for at least two years A little research showed that several other companies were also planning to introduce the same device much earlier and one Japanese company already had one. Inmos would be late, and therefore a failure. Q E D

It could be argued that Inmos itself aggravated this situation by not giving more detailed information about its planned product profile but then again why should they offer such long term commercially-orientated information to anyone when they are setting forth into one of the most commercially cut throat industries the world has ever thrown up?

Against this background of usually ill-informed acrimony it is interesting to stand back and assess what Inmos is, what it is likely to be, and whether it will actually achieve the aims it has set out to meet. This latter part is after all the most important. What the NEB has set out to create is a tremendous gamble. But it should not be condemned out-of-hand for that reason alone. No company starts without someone taking the gamble, be it a computer retailer or the British Government. As in Inmos case it was the latter there should be sneaking admiration for them having the nerve to actually try it themselves rather than decry British industry for not having a go.

So, what is Inmos all about, and where is it going? Though it has been the 64K RAM that has been bandied about as its only product, its intention is to produce a *complete* product profile based around a microprocessor family that will obviously include not only the micro but interface circuits, peripheral controllers and, yes, memory parts.

The infamous RAM is just the first device the company is making, and that has been chosen for a variety of reasons. Firstly, Inmos director Paul Schroeder is something of a whizz at designing the beasts. Secondly, new memory parts always lead the way in technological development, design and processing requirements. Prove yourself able to make true 'leading edge' memory components and the other devices will follow, if the necessary design skills are available.

Here in many ways lies the key to the future of Inmos. It will be the design of its *microprocessor* that will essentially make or break the company, not the 64K RAM.

Exactly what the micro may look like is as yet unknown, and there is no real reason for the company to be too specific about it. Certain assumptions can, however, be considered probable. The man in charge of the design effort, which is being carried out entirely in this country, is Iann Barron, a computer man and ex-managing director of minicomputer manufacturer Computer Technology.

He has gone on record as being in favour of high levels of integration in circuit design, and is also known to favour putting as much of the 'system' into the chip as possible.

It is therefore likely that the Inmos micro will follow a single-chip microcomputer approach with some measure of ROM and RAM on board together with an input/output capability. It could well be a 16-bit processor as well, and may well utilise a programmable logic array approach to its design. Here the ROM would be used to hold a microcoded instruction set that would allow a fair measure of flexibility in the instructions actually selected for the device.

It is no coincidence that the majority of the design team currently employed at Bristol are computer-systems orientated people rather than semiconductor designers. The internal architecture of the device is liable to be sophisticated by comparison with current micros and should be capable of application to a wide variety of functions, ranging from general data processing through to industrial control with the one device.

Barron has gone on record as saying that Inmos will have a new and different philosophical approach to the design and architecture of microprocessors. This could be, of course, just so much flannel and many suspect it is just that. No company, however, maintains a lead in this technology by divine right, and if Inmos can get both the product and the timing of its introduction right there is no reason why it cannot carve out a successful slice of the world market.

'It is no coincidence that the majority of the design team currently employed at Bristol are computer-systems orientated people, rather than semiconductor designers.'

In a subtle way recent statements by two leading members of the semiconductor industry indicate that Inmos maybe can get it right, or at least that it is thinking along the right lines in principle.

The two are Gordon Moore and William Davidow of Intel who in different ways and different speeches have suggested that the technology is exceeding the capabilities of the user to exploit it.

Moore has said that the semiconductor suppliers could well be left with only the memory and low complexity TTL-type markets, for defining new circuits that used the complexity *now* available was becoming impossible. Davidow said that it was time to call a halt to further technological developments to allow users time to learn how to exploit what was already here.

These statements can be taken two ways: as simple statements of fact as perceived by the semiconductor industry, which to a large degree they certainly are, or as an implicit admission by the industry that it has got its overall philosophy and approach to the user all wrong.

One semiconductor man last year admitted that this could well be the case. Garry Daniels, microcomputer design manager for Motorola in Austin, Texas, said that the whole industry had little idea of what it was getting into with the microprocessor and had little concept of the importance of software. The industry tried to sell the beasts in the same way it sold every other part, as a straight component rather than as a systems concept.

This could well be why potential users have not exploited them fully, and why, if Inmos gets its overall philosophy right and produces a 'system' that users find easy to exploit (and that is all potential users, not just the very skilled) then perhaps it will deserve to win a large slice of the market, regardless of being British.

Though patriotism is of secondary importance in the world market economics of semiconductor manufacture, there is one area where Inmos being a British company is important. There have been many cases in the past where British users of microprocessors have been presented with a fait accompli in the design of the device. Yet the systems builders from the country of origin of that device have had the opportunity to provide input into the design process from day one. They have been able to suggest modifications and amendments to the design to make it a better system component for their own needs.

With the UK still acclaimed as the software and systems capital of the world, the input that companies in this country could give to the semiconductor industry would be very significant indeed. With Inmos that opportunity is perhaps available. It must be remembered always that this business is really about *providing the best systems solution to a user's problems*. The technology employed is secondary. In the UK we are good at producing systems solutions, and with Inmos there is an opportunity to tailor the technology to suit that expertise.

One final point about the 64K RAM red herring. Though Inmos won't be in production until 1981, and though other companies have samples available, there are now strong pointers to the market for these parts being relatively dormant until possibly late 1982-83.

The reasons for this are many, but centre around the strong market that still exists for the 16K RAM. Predictions are that over 140 million will be needed next year (IBM is after 28 million alone). Several semiconductor companies have also introduced new versions of the 16K part with a single power supply. This is intended as an intermediate step towards the 64K RAM, for that will require at some stage the systems manufacturers redesigning their equipment to accommodate the new memories. The idea here is to get the users hooked on 16K single supply memories now and then upgrade them to the 64K later. Whether that happens or not, there is a lot of cream for the semiconductor companies to lap up in the 16K business before worrying unduly about the 64K.

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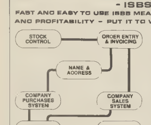

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TRIBUTE TO CHRISTOPHER EVANS

Dr Chris Evans, who stood firmly in the present and looked with wonder at the future, died soon after this interview. He was for many years at the National Physical Laboratory and was internationally known for his work there. Most of this interview revolves around his book The Mighty Micro *which was published in late 1979 by Victor Gollancz and televised by* ATV as a six week series.

Solomon I've come here with a totally blank mind, which may or not be its usual state. The thing is, I didn't sit down and think of a series of questions for you. I've read your book and think it's very good. You're doing a lot of speculation, and obviously it's what you think as well.
Evans *Yes, well, let me give you a bit of background. About a couple of years ago I was invited along with a group of computer scientists, particularly people working in computer research, to attend a not secret but closed conference at Hedsor Park, which, I think, belongs to ICL. The idea of the thing was to get a lot of people together – myself, Iann Barron, people from ICL, lots of characters like that – to work out what was going to be the way things would go with computing, because, as you know, anyone who knows anything about computers at all has realised for at least ten years that something very big is about to happen, and it's maddening in a way that nobody's understood this. Anyway, I was invited to come and give a paper on the future of microprocessors, the social implications. I saw that there were some fairly interesting people going along, all of whom knew their stuff, and went armed with a carefully prepared paper in which I tried to see the impact of microprocessors – what we're really talking about is very cheap computer power, very reliable computer power, very available computer power – and its effect, making the assumption that it's the intimations of a revolution comparable to the Industrial Revolution. Those were reasonable premises and were widely accepted. But what I wanted to try out on this group of people was more which way things were likely to go. I gave the talk – and was very pleased with the result. I found I got nothing but intelligent comments; people whose opinions I respected, who themselves knew an awful lot about computing, came along and said yes, that's quite right. Later I gave a similar paper at an ICC Conference in Canada. There again I got an exceptional response, and then some of the things I said were picked up by a US Government Department, which circulated a report on my speech as an official document. So I said to myself right, I'm not talking a lot of nonsense, and then I thought, I've got a book in this. And thought to myself, if it's written reasonably and understandably I might get the message across to the public. Now, the book is a popular version of my paper. True, nobody can predict the future with any certainty. But what I have done is taken certain facts and made some reasonable assessments as to where things might go. I don't think there's much doubt, unless one is emotionally committed against the idea, that even if I'm seventy five per cent wrong – hardly likely since I don't go into fine detail – we're in for a tumultuous decade. That the computer industry is going to dominate the economies of the industrial countries for about twenty years. And because of commercial pressures, the pace will be frenetic and all kinds of things will happen. So although this is speculation I've tried to make it as hard headed as I can, test bedded my ideas on as many experts as possible, but written my book for the Observer and Sunday Times type of readership.*

Chris Evans

Solomon All right, so you're aiming at that kind of audience. Which leads me to something I've been thinking a lot about. You know that kind of audience is always a dominant social group.
Evans *Yes. Absolutely.*

Solomon And it seems to me – well, I have very mixed feelings about it. Sometimes I tell myself I'm an elitist. I believe in brains. Other times I tell myself not to be ridiculous, people come to the fore from classes [illegible] in that Eric [illegible] mers, whose article I'm using in [illegible], quotes the philosopher Eric Hoffer as saying that when a society is shaken up and turned around, although at the time there may not be much to recommend the actual churning process, results show that there's no such thing as an exclusive group – through heredity or whatever – that's capable of handling the world's affairs. Hoffer gives the Russian Revolution as one example. So I'm in two minds about the computer revolution. Do you think that it will once again re-emphasise the dominance of particular social groups?
Evans *No, I don't think so. I started off as a psychologist and became a computer scientist about fifteen years ago, moving from psychology because I found it unsatisfying, moving to computing when I came to NPL in the early sixties because I found it a vibrant field of study. But I tend to look at life through two pairs of eyes – those of a psychologist and those of a computer scientist. I've increasingly been*

Interview

An[illegible] people [illegible] at the [illegible] and [illegible] things [illegible] that are [illegible] actually [illegible] But like [illegible] the [illegible] is going to [illegible] futures [illegible] Take the case of machine intelligence [illegible] useful for us not to develop it

Solomon A couple of things You say that there's no way we can avoid necessity using computers from the microprocessor in the sewing machine to the huge machine programmed to model the world economy But I'm very worried and I'm sure you are too There are counter-signs in the sense that there's an awful lot of unemployment, and the signs are that it will feed upon itself So what are we going to do about it? Do you have

Evans *No I wanted in my book to write about things I had some confidence about rather than sit around and make guesses If I say that a huge education industry is going to come out of computers then I say that because I believe I'm right and I'm prepared to argue about it But as for unemployment I am no better qualified than the next man to suggest a remedy We have to face up to the fact that all technology brings social turbulence a change in the rules of society But in the past the rate of change has been sufficiently at a gradual pace so that people can more or less adjust Exceptions have of course been things like military invasions – if Attila the Hun sweeps through Europe it's in six months and everything is turned upside down But take the Industrial Revolution which lasted a hundred and fifty years giving three or four generations time to adapt Now the computer revolution is going to run about twenty five to thirty years, so all the problems – unemployment conflicts between one part of the world and another – will be*

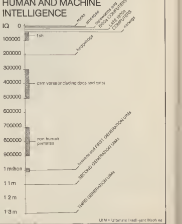
feeling that [illegible] with differences [illegible] intelligence [illegible] I have [illegible] The differences [illegible] between people are [illegible] and I've come to the [illegible] through thinking about things in computer terms And it seems to me that the brain [illegible] an incredible computer that it reaches colossal levels of intellectual achievement and the differences between people are just froth on the surface of that And that is partly why I have that graph in my book It's partly an in-joke but also to show this enormous span of intelligence that you have to have an IQ scale of a million – for all I know a billion – and if you think of this tiny [illegible] of a hundred then you become unduly concerned about minor deviations

Solomon It's something which had never occurred to me before, actually

Evans *Well it's We talk about someone having an IQ of ninety or a hundred and ten when what we should be actually be talking about is someone with an IQ of 999990 and the other of 1000010 – and the percentages are actually nothing So what I think is going to happen is that with the computer revolution which will have a tremendous effect in increasing prosperity and removing drudgery these so-called intellectual differences between people will be ironed out So I think we're going to actually move away from elitism*

Solomon But it won't make people indistinguishable from each other

Evans *Absolutely not Everybody's got his own local software What I feel very strongly is that every human being has the same capacity at birth to cope with the world Now what happens later does as we know create huge differences Okay that's the first thing the move away from elitism The other thing is a more general point which has been growing on me over the last few years is that we are less in control of technology than we think Now I don't just mean by that the terrifying but platitudinous remark Oh dear we've created the nuclear weapon and it's going to destroy us all I mean it much more deeply I think the course of human development is largely dictated by technological developments by market forces and that human beings have very little option but to go along with them And this means that though we instigate the computer the course of the future is really out of our hands because we cannot have a world without computers in the same way that we could not any longer have a world without machines*



(From **The Mighty Micro**)

compressed into and intensified in a very short period of time. There's no easy solution. But what we have got to look at is reconciling ourselves to the work ethic no longer being paramount, that unemployment will not, given increased affluence, mean a lower standard of living: people will be paid more and more to do less and less work. This is a universal rule right across the industrial world. Anyone who doubts it should look at the societies that underwent the Industrial Revolution and contrast them with those that didn't. So I really believe that we're moving to when nearly all the work will be done by machines and people will have to work very little.

Solomon And perhaps think very hard.
Evans *Think very hard – that's something we're very good at. All this I'm confident about and I wouldn't retreat from my position one jot. But when you say – how will we get over the coming decade, the answer is: I don't know. There's nothing a computer scientist can say about that.*

Solomon. Another thing you mention: the intelligent, the ultimate intelligent machine, which has to come about, because we both need and want it.
Evans *Without a doubt.*

Solomon Now, I have some reservations. What I'm about to say is what I've thought a lot about, but I'm not sure I've thought deeply enough about it. That is, you know Godel's theorem, where in a system with a given set of axioms, sooner or later there are theorems in the system which cannot be proved or disproved. Now I've been thinking about this in relation to intelligent machines. Ultimately they've been created by someone, say that their software follows a certain set of axioms which humans have put into them. Then sooner or later the machine can't go outside itself. And I think that for me is what distinguishes the human from the machine. Which is, man is capable of going outside himself in the sense of creating metasystems, stand back and look at himself from, as it were, the outside. And the machine will never be able to go outside itself, contemplate itself.
Evans *I don't really accept that. I don't see any reason in principle why the machine should not create metasystems. It's really operating in the long run by mathematical rules. If you're saying that the machine can't move outside mathematics, that's probably true – but that gives it such a vast universe of discourse that I don't think it would matter very much. Now, although it's probably true that the brain operates on a very different set of principles, those principles too must in the long run be finite. You don't get something from nowhere. The brain has its own territory defined. So, to apply your own argument, one could say that one would never have expected the brain to have created mathematical systems.*

Solomon I still have this belief the human brain is capable of contemplating itself.
Evans *Could be. But that's not really a difference in principle. And we don't really know what the self contemplation might involve. I suspect it's something to do with language – if I had to make a guess about it. If you look at children's memories, these tend to stay in as vivid memories round about the time they begin to acquire language. Partly because language is a way they can describe the world, relate to and separate themselves from it, which is what we mean by self awareness. I don't see really why we won't get the same kind of self awareness in machines once we get to the point where we get a measure of interactive dialogue. Once it begins to be able to separate itself from its environment, then I think you get a kind of rudimentary self awareness in a machine.*

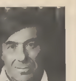
Solomon Let's take creativity. Do you think that self awareness has a lot to do with it?
Evans *Once again, it depends on what you mean by creativity. Computers have created original proofs of theorems in geometry. That's rather dull, but nevertheless, the machine has done something new that has just got to be called creative or the word has no meaning. Mostly people talk about esthetic creation. The computer may never come to that, and it may be the sole province of humans.*

Solomon Well, human beings can make leaps which don't on the face of it seem very logical, but which give results.
Evans *Very good. But on the other hand human beings also make leaps which do not give results. Computers now work by an exhaustive search of all possibilities. Human beings build a base of knowledge, and make the kind of leap you're talking about. I suppose it's perfectly possible to build a base into a computer, then have it make probability jumps. But then what you'd get would be computers dramatically right sometimes and disastrously wrong at other times. You don't want computers to be wrong at all, and you don't care how long they take so long as they come up with the right answers.*

Solomon Do you think you've talked yourself out? Or are you prepared to talk some more?
Evans *No. We'll talk as long as you like.*

Solomon You've talked about Russia – how it is lagging behind.
Evans *Yes, it's lagging behind, at the moment only because the commercial pressures have pushed computing along much faster in America. Any capitalist economy has an enormous capacity for turning over cash – and that has meant the Americans have developed computers for this reason. And the space race led to the American miniaturisation of computers, while the Russians had big boosters capable of carrying bigger – and cruder – computers. America is about ten years ahead of Russia in computers. Of course, suddenly Russia may make the great single tracked effort and pour billions into computing. But the microprocessor is essentially a mass produced, consumer orientated, capitalist device.*

Solomon Russia's economy isn't orientated toward that?
Evans *They can't do it – it would cost a million pounds a chip. What people forget is just how much capital is tied up in chip manufacture. Take all the companies like Texas Instruments – if you tot up what they've invested in the chip, it would be – might be – a hundred billion, if you include everything.*



Solomon An awful lot of money. The Russians *might* do that. But what will they *not* do while they're doing that?
Evans *Exactly.*

Solomon You've led me on to this. Do you think it viable, practicable for Britain to develop its own silicon chip industry?
Evans *I can't really talk about that. As you know, I work for the Department of Industry. But I think I can say this. Where we would have a colossal future is in software.*

Solomon Re-exporting. Added value.
Evans *Precisely.*

Solomon All right. I know it's not strictly your province, you've never claimed universal expertise, but what do you think about the spread of computers into small businesses?
Evans *Well, I think the next wave of buying will not be as gimmicky as it has been. My interests are really elsewhere, but I will say this. As good computers spread, there will be an enormous number of people mad about software. Most of what they produce will be junk, but there will be a lot of breakthroughs. It's like the early days of radio, where amateurs made great discoveries. Some of the people tinkering around will have fresh insights leading to fresh breakthroughs. It's bound to happen.*

Solomon Are you more interested in the frontiers of computing?
Evans. *I'm more interested in the applications, which is why I feel so strongly about the role of the computer in education. The education system has been more or less unchanged up to now – except that more and more money has been put into it. But there seems to be very little to show for it in terms of educational technology. There hasn't been an educational technology. Now there's going to be one, because in a capitalist society, again, there's money – people are going to find that this is a very good way of making money. So they are themselves going to put lots of money into educational technology. From that, there's bound to come a huge breakthrough in computer assisted learning. It's the thing I feel most optimistic about.*

Solomon Can we now turn to universities. I've got this theory that at the turn of the century it was the universities that fuelled a lot of research, a lot of development, a lot of advance. Do you

think [illegible] thing is happening or could happen?
Evans [illegible] It's not happening though [illegible] of the reason is that the money [illegible] from different sources. You need [illegible] actually [illegible] good [illegible] mean to say that the entrepreneur [illegible] but on the whole the really big [illegible] are coming from the big [illegible]

Solomon The commercial motive again.
Evans *All that [illegible] like motor cars. You can work [illegible] and with effort and [illegible] think up an improvement for a carburettor. But there's no thing you can do about the package the [illegible] That comes from General Motors*

Solomon Fine tuning, but little more.
Evans *Yes IBM Rockwell Texas [illegible] people like that [illegible] they are the ones*

Solomon Let's talk about the micro in applications of destruction as the brains of the angels of death — Cruise missiles, things like that.
Evans *It's undeniable. Again [illegible] the money? The people at the US Department of Defence and so forth. It just so happens that microprocessors are very useful in war because they can make weapons intelligent [illegible] is "better" that a man sitting inside the [illegible] and providing its intelligence. It's [illegible] grim prospect. But I think that the really dangerous period was the forties and fifties anyway. We've not got any [illegible] the capacity for the world to destroy itself was reached long ago. You might even [illegible] of the future as the best hope [illegible] the fighting [illegible] [illegible] killer [illegible] [illegible] rule their [illegible] thing. Let them [illegible] and leave us alone*

Solomon Can I ask you a fairly personal question? Do you ever feel jaded or tired, pressure on you [illegible] people keeping on at you [illegible] because obviously you are now of some prominence [illegible] and you always have to dredge up from the depths of your mind something new to satisfy people who are looking for some kind of titillation even in this field.
Evans *Well I think that's a very good point. Answer is no I don't. I do feel the same kind of pressures that anybody who works at the front end of computing feels anyway. You're rattling along on this tremendous wave. But that's part of what it is to be a scientist. One wouldn't want to have it any other way. Now, on the question of moving from surprise to surprise, the field is in fact so stunning that it's not really difficult even if one's motive was simply to produce surprises. It's a bit like the Midas touch [illegible] everything you handle with imagination is almost bound to turn to gold just because of the nature of it. I suppose it's like in the early days anyone involved in the development of machines in the 1820s and 1830s couldn't go wrong. You could make them dig ditches, mines, run railways, spin cotton [illegible] The same is true today*

Solomon Can I put it in a [illegible] for you, and say you're enjoying yourself.
Evans *Oh absolutely. This is one of the great transformation times in history*

Solomon Do you think it's a revolution but [illegible] I was going to say just a revolution, but of course a revolution isn't that trivial. But is it also a renaissance?
Evans *Ahh [illegible] I'm trying to think. Difficult question [illegible] I don't think so. I feel that the nineteenth and twentieth centuries have been one huge renaissance. Because it's really man looking at himself afresh through the eyes of the technologist if you like. Since the coming of the machine the world has never really been the same so we have had to rethink everything. You can see the whole of art, the whole of life, society reflecting the machine. My friend Jim Ballard, the science fiction writer whose work I admire greatly, once said to me "If you could have a single image to represent the twentieth century what would it be?" And I said I didn't know and he said it would be a man sitting at the wheel of a car driving down a highway. In other words it encapsulates all the freedoms, the economic backup, the expansion of people's horizons*

Solomon I'm not going to make a point of it, but doesn't that also emphasise man as an individual?
Evans *Very good. But he's achieved that through technology. If one was to say the same sort of thing about the twenty first century it would just have to be something to do with computers*

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THE QUESTION 'WHY'?

[illegible] but why [illegible] ?

I wanted to write about Gregory Bateson's new book Mind and Nature (1) and his recent visit to London But this clever tall, wise old man is to be taken in slowly you and I will have to wait but you could buy the book anyway

Bateson is one of a gentle mafia people linked by what they do and how, and why Names such as R D Laing, Warren McCulloch von Neumann von Foerster John Lilly, Ivan Illich Spencer Brown Stafford Beer Areas from family therapy to dolphins from computers and cybernetics to evolution and explanations of existence

One day parts – no let's say wholes from their work will blend with will explain and be explained by themes and concepts we usually call political *One day*

Meanwhile let us remind ourselves that the ability to model and to represent aspects of the world including ourselves in media ranging from woodcarving and words to computers and catastrophe theory is one of the most precious we have It is often under-rated but may at the very least do for computing what puberty does for sex, that is to say make it worthwhile

The title of this piece however, reflects a concern that even given an upsurge of interest in computer modelling we should not only ask "what and how" but also why ' Marx said that the point was not to understand the world but to change it – then spent his life doing both More recently in his book Computer Power and Human Reason (2) Joseph Weizenbaum writes, we can count but we are rapidly forgetting how to say what is worth counting *and why* (my italics) I don't think we ever did know, but more of that later

What a day it will be what bells or electronic pings and pongs will ring out when the passive spectator the detached theoretician and the individualistic artist are things of the past, when if I do or make something and you say why? I can explain it so you d *have to understand* and you for me

Let us replace the ubiquitous READY on the screen after listing running or commanding a program or computer Instead WHY or even WHY??! – imagine it!

```
LET X = 26
WHY?
DELETE  PROG1
WHY?
FOR I = 1 TO 1000
1000? WHY?
```

And more importantly let us assume that the population will be X and oil supplies T and unemployment Y
WHY?
Because I want to try it out
WHY?
Because I want to save the world
WHY?
Because I feel I can
WHY?
Because they laughed at me at school
WHY?
Because *Mummy*!

I was on a radio phone in programme recently – me and the 380Z taking turns to evade questions and no one asked why ' It was there and that was that. If type seems more true than handwriting, computer screen screams it at you (The computer has answered, before now, 'why not? , but more frequently tries to change the subject I programmed it of course The danger is when it begins to program me)

It's funny, I've been on the radio several times in the last few weeks (oh, nothing too extravagant So people use computers to make art? ' "Yes, but 'Thank you)– and it was the guy on Radio 1 who got closest to 'WHY? without actually saying it The heavies on Radio 4 *seem* to ask the question but somehow only act it as if rehearsing patterns of justification They ended up with Silicon Gulch comes to Kensington Gore (where the R C A is)

Here's a program do try it – it's not as silly in practice as it looks on paper

```
1 PRINT  WHY ',
2 INPUT A$
3 GOTO 1
```

You can even store the first response and then after as many interactions as you can stand, fish it out again and compare it with the most recent A$ 'So when you said Because I m being paid to' you really meant 'Because I hate Belgians Why?

The trouble with the question WHY? is that many many things can only be *asserted* to be the case rather than proven While an engineer may be able to prove that one bridge is better than another (it is stronger, and costs less) a designer can rarely show that her design is superior to some existing one still less can an artist invoke anything other than value-judgement We need to be able to *show* each other

And yet perhaps a paradox – in day to-day affairs, a description of a thing or event in obvious completely communicable, qualitative terms is redundant as far as any discussion goes – at best a label Most of our conversation when we

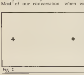

Fig 1

Discourse

describe things, seems to be in qualitative terms

When we have tried in the past to apply value-judgements to decision making, we haven t done very well We often could not articulate the criteria of what was 'good' or valuable Decision making algorithms were generated from inspiration co ordinated by fear and devotion "Man bumbling from one scattered consequence to another, with feelings ranging from surging confidence to disillusioning desperation finally selected an alternative " (3)

Now at least some people are trying to deal with value-judgements, with qualities as well as quantities In computing Work involving the modelling and simulation of creative activity, and people s qualitative inputs to computerised decision aids have been the subject of research at the Royal College of Art for years now In fact it s wryly amusing to read in the computing press of some new research project being trumpeted by a University department In our own way we were doing it when our (what would now be described as 'mini-) computers filled a room you upstarts!

Please, could we begin to consider models and simulations as *art* and as design, not expecting or insisting that when X is 27, Y three million it's a Wednesday and it s raining then Z will be a function of midnight — but rather that by experiencing acting in and upon our creations, we can learn and understand parts and wholes of our world

To understand something, you have to 'stand under' it right? And simply I d often rather stand under a colour than a number We *invent* the world – there is no reality worth all the scientific rigour that excludes values

Look at the diagram (Fig 1) – remember it from school? You close your left eye hold the paper at arms length, and concentrate with your right eye on the cross but be aware that you can see the spot too If you slowly bring the paper towards you then at a certain point the spot disappears School kid stuff Optic nerve Sure

If there's a blind spot , that can't see how come the spot on the paper vanishes? It should still be there! Your brain *invented* white paper and it works on coloured paper too All you need No objectivity! Back to the computer Let s get it (vaguely) right!

References

1 Bateson G *Mind and Nature* Pub Wildwood House 1979

2 Weizenbaum J *Computer Power and Human Reason* Pub Freeman 1976

3 Shelley M W *Judgement and Optimality* Pub Wiley 1964

The author is Research Fellow in Computing at the Royal College of Art

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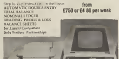

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MICROCOMPUTERS IN THE LEGAL PROFESSION

[illegible]

It [illegible] tradition that [illegible] Computer Revolution [illegible] had a significant effect upon the legal profession. An official survey [illegible] 114 legal firms (3% of which [illegible] computers, of which a mere 2% had [illegible] systems. Whilst this number [illegible] increased substantially in the [illegible] years, the total solicitors user base [illegible] very low.

However it quickly becomes clear from a study of the solicitor's environment that there is considerable scope for the talents of the micro-computer in the legal profession. This potential is now being explored by an increasing number of computer suppliers and the benefits are already being appreciated by an enthusiastic market.

[illegible] The Royal C[illegible] (1979). Whilst [illegible] social stability [illegible] traditions [illegible] have prevented solicitors [illegible] offsetting their increasing c[illegible]. For example in a typical family [illegible] matter where tradition has dictated the annual legal fee for a very long time, solicitors have been slow to realise that they are entitled to charge higher rates and equally the client has stubbornly refused to accept any break in such time honoured tradition. Somehow public attitudes assume that traditional professions should be immune from the ravages of inflation suffered by normal commercial enterprise!

As well as suffering diminishing profits the legal profession are finding it increasingly difficult to raise working capital [illegible] partnership were often more closely related to wealth than ability. [illegible] the case [illegible] completely reversed but the young able solicitors who can do much for the business are generally unable to provide capital in the first place.

The best way to reverse these unpleasant trends is to reduce the overhead and increase revenue. As this article will explain, the microcomputer can achieve this by staff savings, the provision of meaningful management information and even by the justifiable increase in revenue thanks to an effective time recording system.

Following this brief outline of some of the problems facing the legal profession today, it is now appropriate to consider how the modern solicitor is utilising the microcomputer's capabilities and what benefits he is experiencing.

The main application areas to have been computerised so far are:

1. **Time recording and costing**
2. **Financial accounting**
3. **Debt collection**
4. **Word processing**

Solicitors

Other [illegible] by solicitors and the [illegible] include

5 **Information retrieval**
6 **Conveyancing support**
7 **Probate support**

The latter solutions are the [illegible] and will provide further [illegible] favour of the microcomputer. [illegible] within the first four areas there [illegible] for the solicitor to get his teeth into and ample benefits to cost justify the [illegible] investment involved.

Time-recording

The foundation for a time recording system involves the completion of a daily or weekly time-sheet by each fee earner. The fee-earner's full working day should be recorded by noting each matter description on which the fee-earner has worked and the type of activity. It is equally important for the fee-earner to record non-productive time, as the system can provide a useful analysis of each fee earner's administrative overhead.

The information on the time sheets is fed into the microcomputer and stored in client/matter sequence. Thereafter a fee earner can enquire on any individual matter to see how much time has been spent on it, and what the value of that time is at chargeable rates. This information is extremely useful to the solicitor when he wishes to prepare a bill for a particular client. He will be able to study the individual elements of time spent on the matter and thereby assess what charges he should make to the client.

As many solicitors are now discovering, the fees they have recently been charging to their clients have not reflected the amount of time they have spent on their clients' problems. Typically solicitors have found their fee income increasing by 33% during the first year of running a full time recording system. However any such dramatic increase will undoubtedly raise the clients' eyebrows, which may force the solicitor to justify his account in detail. This can be achieved by the presentation of detailed time transactions itemising the time spent on an individual matter. A word of warning is necessary here to all potential buyers. Many computer systems only offer a summarised time recording system which is not acceptable to the taxing authorities whose job is to arbitrate on disputed bills. In addition, the maintenance of a time recording system on a manual basis involves considerable clerical work which might easily detract from the benefits of the system.

In other words, time recording is clearly a case for computerisation. Once the fee earners have been persuaded to complete daily time sheets, the transition to a computer system can be very straightforward. Thereafter the benefits are considerable.

A further spin off from the computerised system is the management information provided as an automatic by-product. This can include reports such as a Fee-earner Performance Report, which shows the average productivity of each fee earner and compares his monthly billings against target.

Alternatively a Management Performance Report monitors the workload of each department by reporting on the number of matters handled each month. Reports of this type help to ensure the most effective utilisation of each fee earner's capabilities and to maintain a regular flow of revenue into the business.

Financial accounting

Together with Time Recording, it is natural for the legal practice to install Financial Accounting on a microcomputer. The legal accounting system involves a vast number of different transaction types within the Client and Office accounts, and it is governed by strict rules enforced by the Law Society. The microcomputer, with its power and flexibility, can handle all these permutations with ease, and reduce all financial input to one standard format using code numbers for the various transaction types.

'As well as suffering diminishing profits, the legal profession are finding it increasingly difficult to raise working capital.'

Further significant advantages are available to any legal practices that operate branch accounting systems, and the many amalgamations that have resulted recently. Because of the problems of several [illegible] that branch accounting is a common situation. This often involves the need for experienced cashiers in every branch office. However a lot of the skill needed on a manual system can be superseded by the use of branch terminals, linked on line to the central processor, and operated by a relatively unskilled person.

As with the Time Recording system, the microcomputer can offer many by-product benefits in the way of management information. Typical financial reports which should be available to the solicitor include:

1 **Matters not moved for n months**
2 **Matters approaching credit limit at billing value**
3 **Matters exceeding £ n at billing value**
4 **Income and Expenditure Report**
5 **Unbilled disbursements by partner/managing fee-earner**

Reports of this type help the solicitor to maintain a healthy cash flow, control expenditure and generally manage his business more efficiently.

With [illegible] consideration the [illegible] solicitor has [illegible] the emphasis must [illegible] A [illegible] enables a [illegible] all major [illegible] can be read fairly [illegible]

An excellent example [illegible] Partners Control Report [illegible] Solicitors Accounting [illegible] by Burroughs [illegible] single sheet of paper which [illegible] time (via a security [illegible] at a glance the [illegible] key areas such as [illegible] and Expenditure month [illegible] Profitability year to date [illegible] at billing value, unbilled disbursements and Unpaid Bills over different aged periods and the total Client and Office balances.

Sophisticated reports of this type are extremely useful to the modern solicitor and they are now available by means of the microcomputer and, more importantly, a well designed software package.

It is an appropriate stage to mention briefly, for the benefit of the new user, the importance of the package or Program Product approach to software. A well designed Program Product should be capable of containing over 95% of all Solicitors' accounting requirements. In which case it is quite pointless for the solicitor to search elsewhere for a software solution, either by borrowing second hand software from another installation or, worse still, by trying to re-invent the wheel by designing his own system from scratch. The penalties here are enormous in terms of time and money and the final solution is unlikely to be as good as a Program Product.

Debt collection

Closely linked to the financial accounting system and an area of increasing interest to the modern solicitor is computerised debt collection. A large number of legal practices are involved in debt collection as it is a natural spin-off service for the client and, if the volume of activity is sufficiently high, the commission charged for this service can become quite substantial. And of course any debts that are not recovered normally provide the firm with additional litigation business.

The clerical problems, as far as debt collection is concerned, involve constant monitoring of individual debts and prompting of various different actions according to the age and status of the debt. A lot of repetitive typing is involved on different forms.

One firm, based in Leeds, have successfully computerised this system utilising a Burroughs B1700 computer to handle 8500 current debts. Once the details of the debt have been entered into the system, the computer executes the various stages from letter of claim, to summons, to request for entry of judgement, to request for warrant of execution quite automatically. If the debtor pays up at any stage the automatic process can be suspended. Thus the clerical effort is minimised and the system is kept completely up to date at all times.

This system is now being adapted to run on Burroughs microcomputers and it will include automatic linking to the SOLACS financial accounting system.

Word processing

The capabilities of the microcomputer as a word processor have aroused as much interest within the legal profession as any other area. A solicitor effectively makes his living from his ability to interpret words and to present them in the most effective sequence for the benefit of his client. Once a solicitor has found a successful word pattern to handle particular problems he quite sensibly uses the same phrases again under similar circumstances. The repetition, usually with minor amendments, has created the need for a word processor, a need which is very well filled by the power of the microprocessor and the storage capabilities of mini-disk.

Word processors can substantially [illegible]

Conclusions

All in all the microcomputer has a potential to offer the modern solicitor and the [illegible]

Solicitors

[illegible]

'A Solicitor effectively makes his living from his ability to interpret words and to present them in the most effective sequence for the benefit of his client.'

[illegible]

becoming less important. There is now available a wide range of hardware with capabilities well beyond the requirements of most solicitors.

- The vital area for consideration now is the software, or the programs required to run the system. In all cases the solicitor should opt for a standard package.
- Furthermore he should satisfy himself that the package is complete by insisting on at least one visit to an installation which has run the package long enough to know whether it fulfills all their requirements.
- The only way to guarantee a smooth initial installation is by thorough training of all personnel, i.e. the operator(s) must be trained on the hardware, the operator(s) must be trained on all aspects of the package, the administrative partner must be given overview training on the package and full training on installation management. Finally, all fee earners and secretaries must be trained on documentation and how best to utilise the new system. All this can and must be supplied by the computer manufacturer or his agents.
- Finally, the prospective user must satisfy himself that the supplier will provide continuous on-going support and maintenance as much for the software as for the hardware.

Selection of the correct system will ensure a successful installation and the microcomputer can contribute substantially to the overall efficiency and profitability of the legal practice.

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ACCOUNTANTS' GUIDE TO MICROCOMPUTERS

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Photo Yoshi Imamura

[illegible]

A[illegible] been [illegible] in[illegible] but [illegible] deep[illegible] in the [illegible] during [illegible] challenges [illegible] the [illegible] hardware [illegible] their clients [illegible] (software).

One of the first [illegible] counter is that [illegible] their clients that the[illegible] computer equipment because [illegible] £25 000 and more [illegible] them a magazine and show similar equipment costing less than £10 000.

It is not good enough to say that the latter equipment is inferior to that supplied for £24 000 by some well known brand name because if you analyse both sets of equipment you will probably find that most of the peripherals (e.g. printer, visual display unit and disc drives) in the less [illegible] the [illegible] with the [illegible] the [illegible]

> *'I think it is more important to establish the needs first and then select the equipment.'*

It is necessary to accept the fact that equipment supplied by the microcomputer industry, subject to the checks that I will deal with in this article, [illegible] good as that supplied by the [illegible] established vendors of computer and accounting equipment. And [illegible] of the people writing software [illegible] worked on large computers [illegible] very good software [illegible] I will [illegible] — both [illegible] — in the next [illegible]

[illegible] the [illegible] where the [illegible] I think it is more important to establish the needs first and then select the equipment rather than [illegible] Then [illegible] minifloppy based systems [illegible] of offices which were bought on the understanding that they [illegible] Purchases [illegible] but which in reality [illegible] than one tenth of the [illegible]

Unless [illegible] machines can be moved to some other department where the processor or data file requirement is lower, the money spent on the particular machine [illegible] down the drain.

The [illegible] points to be worked out with the equipment supplier or software house are:

- 1 What are the applications you wish to [illegible] the machine within say two, three [illegible] of purchase.

- 2 How much data storage will [illegible] for the supplier [illegible] names and addresses for customers and how much information will you keep with stock records, what personnel records will you need etc
- 3 How much of the information in (2) will need to be on line (i e available for use) all at the same time
- 4 How many people will want to use the equipment at the same time
- 5 How many of those people will be entering information (e g orders stock movements etc) and how many will be only using the equipment for enquiry
- 6 Will the enquirers use the equipment regularly (e g estate agency) or casually (e g managing director)
- 7 How many of the users in (4) will need to access the same information (or database) If they are users who have their own unique database perhaps it would be better if they had their own microcomputer
- 8 How much printing will be required and will it be required to be high quality (e g for letter and report writing) or computer quality (i e dot matrix)

This is not an exhaustive list of enquiries but it will enable you to establish three very important points before you discuss the matter with the supplier

The type of disc storage required
Whether you need a machine that is multi user multi-tasking
The quality and speed of printer

There are generally four types of drives — 5¼ floppy (with capacities between 75 000 and 350 000 characters each) 8 floppy (with capacities between 250 000 and 1 000 000 characters each) hard Winchester Type discs (with capacities of 10 000 000 characters and upwards) and

Accountants

cartridge drives (with capacities of 10 000 000 characters and upwards)

In establishing [illegible] it will be necessary to allow space on the programs you wish to use and also a work area (like a jotting pad) for the computer to shuffle data around. These points should be discussed with the software expert

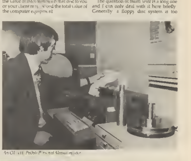
The other point of great importance in selecting drives is the question of back up of data The cost of media, the floppy discs on which data is stored, is cheap The cost of a typical floppy disc is £3 54 — but the value of information on that disc to you or your client may exceed the total value of the computer equipment

To back up effectively it is essential to have two drives This is straightforward in the case of floppy drives or in the case of cartridge drives where there is a fixed and a removable pack But problems arise in the case of the fixed Winchester drives which some companies are selling for cheapness The recommendation given by these companies is to back up the updated information on to floppy discs each day My own view is that many employees would object to have to spend up to an hour a day on this tedious chore And I do not think it would take you long to work out that with the rising cost of staff it would pay to spend a bit more capital now to have a faster and more efficient system which would save money in the long run

The question of multi user is a long one and I can only deal with it here briefly Generally a floppy disc system is too cumbersome to cope with more than 2 or 3 users at the same time so it is necessary to establish how many are likely to be entering data or making enquiries simultaneously

Not many microcomputer companies sell effective multi user systems It is essential to check that those that do know and can support their system and that their equipment is top quality since use of less than top quality parts or less than a top quality design can affect the reliability of the system

Finally an important point to arrange is the question of maintenance Few microcomputer companies carry out their own maintenance but tend to place the contracts with reputable third party maintenance companies Response time to a fault call is normally 24 hours but can be less by arrangement Cost is normally around 10%/15% of the capital cost of the equipment



An Ol[illegible] P6060 [illegible]

A [illegible] in the Byte Shop [illegible]

Mike [illegible] is the MD of Equinox Computer Systems Limited

WHY NOT A COMPUTER IN YOUR BUSINESS?

The author [illegible]

PART TWO

In th[illegible] the question of [illegible] far mo[illegible] what [illegible]

In the last [illegible] nd the imp[illegible] p[illegible] Many [illegible] looking [illegible] at the [illegible] l [illegible] this, leaving the [illegible] has been [illegible] a [illegible] deal [illegible] day the [illegible] your [illegible] you [illegible] choosing [illegible] all compu[illegible] weaknesses [illegible] BEST BUY, regardless [illegible] isements [illegible] will come int[illegible] the system the [illegible] a 8K cassette PET [illegible] you stock the Apple [illegible] processing [illegible] proach a problem [illegible] software [illegible]

[illegible] By putting the sort of [illegible]

- stand [illegible] chance of seeing statements produced
- give the [illegible] hand to produce its most [illegible] system
- get the [illegible] the firm's competence [illegible] the system's credibility

> 'There is no simple Best Buy, regardless of what the glossy advertisements say'

If, on the other hand [illegible] cassette based 8K PET [illegible] an application for which [illegible] ed you have only yourself [illegible] salesman sells it [illegible] appease his conscience [illegible] that that was what you [illegible]

If you accept [illegible]

the most important [illegible] business system [illegible] that it is stupid [illegible] It is equally stupid to [illegible] sometimes adopted by the very people who should know better — the [illegible] with more [illegible] ends. You may be [illegible] expert that a micro [illegible] be proposed for a [illegible] — the implication being that [illegible] want to play Startrek all day then consider [illegible] by all means but if [illegible] ledger you must [illegible] least £10,000 [illegible] there are usually vested [illegible] the minicomput[illegible] being under [illegible] about the [illegible] his mainframe the [illegible] to defend his [illegible] the simplest sys[illegible] months despite having a small [illegible] the Consult[illegible] the ethics of his [illegible] keeps re[illegible] he knows a [illegible] general [illegible] system at [illegible] £25,000 or [illegible] failure [illegible] will depend on [illegible] training good systems design, documentation, manual systems engineering and software support from the supplier — but hardly ever just on the cost of the hardware.

Keep the goal firmly in sight

A lot of businessmen feel confused when trying to choose a system. They are dealing with a new industry, a different technology and a whole new language (or jargon!). But if you concentrate on the software rather than the hardware initially the process of weeding out unsuitable systems should be considerably simplified. Keep in mind what you really want the system to do and, as you see various demonstrations, you will find you are getting better at sorting the wheat from the chaff.

Sorting through rubbish

Talking of which, I regret to say there is a good deal more chaff than wheat amongst the software packages available! It is hard to believe how bad some of the software on sale really is! The reason for this is mainly that the low price of micros has already made them available to a very wide range of users — and some of those users fancy themselves as programmers. There is no law against describing yourself as a programmer after a few short weeks spent writing BASIC programs on a micro but that does not turn you into a professional qualified to produce business packages and sell them. It takes a lot of training and experience to design and implement a system that is easy to use, flexible, expandable, with audit trails to satisfy your conservative accountant and error handling to keep the junior temp out of trouble when she has put the purchase ledger floppy disk in upside down.

So please approach all software with caution, assuming the worst. There ARE good systems around too, but you cannot judge on price alone, you have to probe a bit.

Not discouraged, are we?

At this point you may feel like dropping the whole idea — it sounds too full of pitfalls. If you feel like that at this stage you may in fact be better off without a computer, for it is essential that you are committed to finding a solution if you are ever to install a good system. If you want to buy a system to play with, that's fine, you can ignore many of the precautions suggested in these articles. But if — as with most businessmen — you aim to improve your efficiency or reduce your overheads by installing a computer, then you must do a lot of thinking about what system you really want. There is no easy way but the rewards for those who persevere are considerable.

During your search for good software you may consider several alternatives:

1 **Buy a package**
2 **Write the programs yourself**
3 **Get a knowledgeable friend to write them for you**
4 **Get a system written by a software house**

First, hunt your package . . .

At the risk of boring you with repetition I urge you again to only look at alternatives 2, 3 and 4 if you are certain that a package to do what you want is not already available. The reasons for this are:

1 It is safer to buy a package which you can see rather than a promise (which is what the other choices amount to).

2 It will be MUCH cheaper than alternative 4 and probably cheaper than alternative 3.

3 Your system will be productive in a matter of weeks rather than months — and the sooner it is productive the sooner it is saving you some of the money you invested in it.

4 If you have not used computers before you cannot possibly know in detail what sort of system you will want to operate in a year or so. Much better to start with a package which will have at least some of the thinking done for you rather than trying to think the whole grandiose scheme out for yourself and specify it to someone who does not perhaps fully understand your business.

'So you have found a package which seems to do roughly what you want. How do you check it out?'

So please look hard for a package. Do not take no at first. Some people say they do not want a package because 'our business is different'. Everyone's business is different but a good package takes this into account and gives you flexibility. I once heard an American salesman's answer to that argument. He said: 'When you want a car, do you go to an engineer and say "please design me a car to suit my height and weight and personal preferences?" or do you go and buy a Ford? Non-standard people buy standard cars because it is far too expensive to consider a tailor-made car.' Similarly with packages. More people would buy a package if they realised the true cost of having software written.

End of the search . . .

So you have found a package which seems to do roughly what you want. How do you check it out?

1 Ask to try operating it yourself. Is it easy to use? Try making a few deliberate mistakes and see how well it copes. What you must try to do is test it for half an hour with all the errors your company is going to make in a year. If it asks for an invoice number, press RETURN. Does it collapse? Try entering ABC when asked for a VAT account. Does it 'die' with SYNTAX ERROR or does it merely ask you patiently to resubmit the information? Does it have ERROR HANDLING (if you enter ABC it explains that numeric information is what is wanted and gives you a chance to resubmit), or does it have only ERROR TRAPPING (entering ABC gives you a jargon type message such as ERROR 243 HAS OCCURRED AT STATEMENT 1255 and no further help towards recovering the situation) or does it (heaven forbid!) have no error processing at all (entering ABC causes the program to abort, leaving you with your files partially updated and an hour's work trying to get back to where you were when you started). MAKE SURE YOUR PACKAGE HAS PROPER ERROR HANDLING, NOT ERROR TRAPPING OR NOTHING AT ALL.

2 Let us assume it is a sales ledger package, showing the balance on any customer's account within a few seconds. Excellent, but does it also produce an audit trail showing how that balance has been arrived at? If not, how are you going to answer the questions of your accountant, your auditor or the customer whose figures differ from your own? A COMMERCIAL PACKAGE THAT DEALS WITH FINANCIAL TRANSACTIONS WITHOUT A COMPREHENSIVE AUDIT TRAIL IS WORSE THAN USELESS.

3 How is security catered for? If you spill a cup of coffee over the floppy-disk containing your purchase ledger, how are you going to retrieve the situation? An instruction in the documentation advising you to take copies of the files regularly is hardly sufficient. Suppose you did take a copy. You find it, load it into the system and it displays a balance on the ledger of £24 567.37. You know the current balance should be £27 331.24 because that figure is on a report which you printed just prior to spilling the coffee. But how do you update your backup copy to produce the correct balance? What was the last invoice you posted to the file you now have? If you knew for certain that it was number 2477, at least you would know that you could post all the invoices produced AFTER 2477 and you should arrive back at the correct figure. The better systems will keep track of the last invoice/credit note/cash payment posted and include a special program to copy the files which will also list this information out, so facilitating recovery should you ever need it. THE MAJORITY OF CHEAP PROGRAMS CONVENIENTLY IGNORE THE BACKUP AND RECOVERY PROBLEM BECAUSE THEIR AUTHORS HAVE HAD NO TRAINING IN THE SUBJECT.

4 The chances are that a good package will do 70-80% of what you want. But how about the other 20-30%? You should be aware that altering a package can often be very complex. Some packages are built to be tailored, others are not and you must take them as you find them or not at all. So make sure you know before you buy into which category your package falls! Also consider how important that 20-30% really is since it may be expensive. Could you in fact live without it for the sake of getting the 80%? ALTERING A PACKAGE CAN SOMETIMES BE MORE COMPLICATED THAN STARTING FROM SCRATCH! DO NOT BE TEMPTED TO TRY IT YOURSELF.

5 Look at the documentation. This is an excellent guide to the care that has gone into the rest of the package. If there is none (amazing, but it happens!) or only a few scrappy duplicated notes then beware. Check that what there is matches the version of the package you are looking at. It may be out of date and quite useless. Beware of the salesman that offers to write it for you on the spot. It should not be necessary and shows that the package is probably a hand-to-mouth effort best avoided altogether. The idea of documentation is that it should enable you to run the package without constantly ringing up the supplier to settle queries. Unfortunately good documentation does not come

Business

cheap but it can be very expensive [illegible] Remember that your current staff may not be with you for ever so you should plan for training new people to use the system. For that you will need adequate written instructions. DOCUMENTATION IS VITAL AND IS A GOOD GUIDE TO THE QUALITY OF THE REST OF THE PACKAGE.

6 Ask about software maintenance. Is the fixing of errors included in the price you will pay? If a new release comes out with enhanced facilities, will you receive it automatically? (Probably not but worth a try!) If it is a payroll program then it will obviously need maintenance to cater for tax changes which are bound to occur. An out of date payroll is worse than useless so make sure you understand exactly what you are being offered. Even a Sales Ledger program will need some maintenance so find out who is to do it. It is worth adding at this point that ALL packages have errors in them somewhere since a program is a very complex structure. So do not demand your money back if you get an error. It is however reasonable to expect a maintenance service to put the fault right if the program cost more than £50 or so. Some packages come with a maintenance contract just like for a piece of machinery. IT IS VERY DIFFICULT TO FIX A PROBLEM IN A PACKAGE WRITTEN BY SOMEONE ELSE UNLESS THERE IS EXCELLENT DOCUMENTATION.

Summing up

In summary, look closely at any package and if it passes the tests suggested above you can probably buy with some confidence. A good package is not going to be cheap unless the supplier feels he can sell it in great numbers, but I hope that by now at least you appreciate where some of the money goes. You cannot judge on price alone, but you should be wary of very cheap software. Good software is only produced by good programmers and they command good salaries. Notice that many of the tests involve *assessing the supplier as much as the package* and that is very important. A computer is not a simple purchase and — like it or not — you are going to be dependent on the supplier of your hardware and software. Make sure you trust his judgement: your computer installation's success could depend on it!

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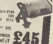

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APPLE PASCAL

Martin Beer

Photo: Yoshi Imamura

The APPLE II has proved to be one of the most adaptable microcomputers in the current marketplace. Starting off as a simple single-board with INTEGER BASIC in Read Only Memory (ROM) it has been developed into a very versatile system with the option of INTEGER BASIC or APPLESOFT BASIC both in ROM, Mini-floppy diskette drives and various peripheral controllers which slot into a series of edge connections along the back of the main processor board.

There has been considerable interest therefore in the latest of APPLE's software announcements, a complete PASCAL system implemented by Professor Bowles' group at University of California, San Diego. Professor Bowles' group have developed a compiler for PASCAL which generates code for a hypothetical processor called a P machine. The machine code generated for this processor (normally called P-code) allows a particularly efficient PASCAL compiler to be written. The P code generated by the compiler can either be translated into machine code for a real microcomputer or, more usually, be used as data for a machine code interpreter which actually executes the program. This approach is particularly suitable in microcomputer applications since PASCAL can be implemented on a new microcomputer system by rewriting just the P-code interpreter, with a considerable saving in both time and effort, since the compiler itself remains unchanged. The PASCAL compiler itself is written in PASCAL so that once it is compiled into P code it can be transferred from computer to computer with relative ease.

Professor Bowles soon realised that whilst simple programs could now be transferred with the compiler, most useful programs, including the PASCAL compiler itself, interact intimately with the programming environment. Programs need Input and Output, as well as temporary storage. This means that the program must communicate with the host computer's operating system. Since no standard operating system was available (even CP/M (tm) is only available on computers using the 8080 or Z80 processors) considerable changes would be required in any program which required operating system intervention before it could be transferred to a new computer. Professor Bowles decided to develop a portable operating system, written in PASCAL, so that the whole operating environment transfers from computer to computer. This should allow programs to be ported with absolutely no changes.

The APPLE PASCAL system is an almost complete implementation of the UCSD compiler and operating system. The only sections which have been omitted are those which are not likely to be relevant to APPLE owners. UCSD provide two text editors, a line editor suitable for teletype and other serial terminals, and a screen editor which can be used with cursor addressable [illegible] the APPLE screen [illegible] is ideal for the screen [illegible] the [illegible] provided instead [illegible] that APPLE owners [illegible] to use the APPLE BASIC [illegible] UCSD BASIC is not supplied. [illegible] Debugging facilities in [illegible] not supported in APPLE PASCAL.

The PASCAL [illegible] APPLE or APPLE II [illegible] full complement of 48K [illegible] access memory (RAM) [illegible] Provision is made for [illegible] disc drives, a printer, [illegible] connection to another computer and an independent console should these be required. No provision for tape input/output has been made in the PASCAL system although of course tape storage can still be used with BASIC.

First impressions

Table 1 gives a list of the major items provided in the APPLE PASCAL package. The mass of documentation is impressive, if not overwhelming for the first-time user. Much of it is not new, but none the worse for that. If the PASCAL USER MANUAL and Report and Kenneth Bowles' text book were not included they would have to be bought to make full use of the system. The PASCAL User Manual describes "standard" PASCAL, at least until a full formal specification is approved and published. It provides a very good introduction to PASCAL for an experienced programmer, as well as being a valuable reference work. On the other hand Kenneth Bowles' book is an introductory text book and introduces modern programming practices in terms of UCSD PASCAL.

The Language System manual gives detailed instructions for installing PASCAL on your system together with a simple introduction to using PASCAL and BASIC once it is working. The APPLE PASCAL Reference Manual is [illegible] of the UCSD Reference Manual [illegible] all the material which is relevant to the APPLE system. With over three hundred pages it contains a wealth of information on the system and its use, of value for [illegible] long time. Not only is the software and its use described in full, but a full list of P code instructions is included together with a description of the P machine.

The APPLESOFT Reference Manual and the BASIC Programming Manual are long-standing APPLE publications which most APPLE owners should have already. Extra copies, especially of the APPLESOFT Manual are always welcome. Finally, the APPLESOFT TUTORIAL is a rewrite of the BASIC Programming Manual using APPLESOFT rather than INTEGER BASIC for distribution with new APPLES with APPLESOFT included on the main computer board, rather than INTEGER BASIC. It gives a clear introduction to both BASIC and the APPLE which first time users should find very useful.

The hardware is very attractively packaged in foam packaging within a multi-coloured wrapper. The language card provides another 16K bytes of RAM to replace the BASIC ROM area and an Auto Start ROM. When installed the APPLE has a full 64K bytes of RAM available. One useful feature is that the edge connector is gold plated, thus eliminating the connection problems inherent with solder coated connectors as used with previous APPLE peripheral boards. Whilst these are not serious, better edge connectors will eliminate the need to clean them occasionally. New PROMs are also provided for the boot disc controller board so that it can boot from a PASCAL disc. An integrated circuit extractor is also included so that the old PROMS can be removed without damaging either them or their sockets.

Finally, the package contains six diskettes in three protective card envelopes. These are again printed in colour and introduce the APPLE DISCWARE label which will presumably be used on further software products as APPLE introduce them. Four of the diskettes contain the PASCAL system, together with a number of utility and demonstration programs. The fifth diskette contains both APPLESOFT and INTEGER BASICS so that the appropriate one can be loaded into the language card and write protected so that together with the ROMs provided on the main board, the APPLE will behave as it did before with both INTEGER and APPLESOFT BASICs available as required. The last diskette is blank, to provide space to get the system started.

All diskettes are formatted for the PASCAL system and are incompatible with BASIC DOS Diskettes. Equally, DOS diskettes cannot be used with the PASCAL system. In fact the APPLE behaves almost as if it were two separate computers depending on whether BASIC or PASCAL was being used.

Major Items supplied in the APPLE PASCAL Package

1	APPLE Language Card
2	Replacement PROMs for boot Disc Controller Card
1	Integrated Circuit Extracter
4	PASCAL Diskettes (Labelled APPLE 0 APPLE 1 APPLE 2 and APPLE 3)
1	BASICS Diskette (Labelled BASICS)
1	Blank Diskette
1	copy APPLE Language System Installation and Operating Manual
1	copy APPLE PASCAL Reference Manual
1	copy PASCAL User Manual and Report, K Jensen and N Wirth
1	copy Microcomputer Problem Solving Using PASCAL K Bowles
1	copy APPLE II BASIC Programming Manual
1	copy The APPLESOFT Tutorial
1	copy APPLESOFT II Reference Manual

TABLE 1

Installation

Full instructions for installation and checking are provided in the Language Card Installation and Operating Manual These should be read *very* carefully before proceeding further Integrated circuits are delicate and can be destroyed easily if not handled properly when inserting or extracting them from their sockets APPLE have thoughtfully provided a suitable extractor tool which should always be used to remove integrated circuits from their sockets This way damage to both the circuit and its socket should be minimized

It is best to remove all the peripheral cards from their slots at the back of the APPLE before starting installation (most of them will have to be removed anyway) The first job is to put the Language Card into slot 0 to replace the APPLESOFT ROM card A 4116 memory chip also needs to be removed and is replaced by a ribbon cable and header on the Language Card It is easier if this is done before the card is finally inserted in its slot The 4116 can be kept on a piece of conductive foam and used as a spare should one be needed

Package

The disc controller card must now be dealt with This is somewhat more awkward since there are two PROMs which must be swapped The only means of identification is the mark number printed on the top (which might be covered with an APPLE copyright sticker)

APPLE give very detailed instructions on how to identify both the old and the new PROMs These instructions should be followed implicitly If the markings have worn off your PROMs or you cannot find the right numbers contact your dealer for help If the wrong PROMs are replaced or the new ones are the wrong way round the APPLE will not work I found it necessary to bend the pins of the new PROMs slightly to ensure that they are inserted properly into the sockets If necessary do this with a fine pair of jewellers pliers which have just been earthed — not with your fingers Under no circumstances should you touch the pins under the integrated circuit with your fingers as any static charge on you will destroy the delicate circuitry inside it

After installing the PROMs double check everything Make sure that all the circuits are the same way round (the slot in the top of each integrated circuit should be at the same end) If all is correct the controller is ready for reinstallation into the APPLE It *must* be returned to slot 6 for the system boot to work correctly

Any further peripheral cards may now be replaced Unlike APPLE BASIC APPLE PASCAL assigns particular functions to the different slots (Table 1) This may require some rearrangement of peripherals ALL APPLE s peripheral cards will work with the PASCAL system as will those of independent manufacturers who follow APPLE s conventions very carefully Special peripherals such as the SPEECH LAB and Real Time Clock cards must be dealt with separately although they can of course still be used from BASIC in the usual way

Slot	Use	Recommended APPLE Interface Card	PASCAL Device Name	Device Code
0*	APPLE Language Card	—	—	—
1	Printer	Communications Card Serial Card Parallel Printer Cards	Printer	6
2	Modem (remote communication)	Communication Card Serial Card	REMIN REMOUT	7 8
3	Remote Console	Communications Card (Serial Card)	CONSOLE	1
4	Additional Disc Controller	Disc Controller Card	—	9 (drive 1) 10 (drive 2)
5	Additional Disc Controller	Disc Controller Card	—	11 (drive 2) 12 (drive 2)
6	Disc Controller	Disc Controller Card (PASCAL ROMs fitted)	—	4 (drive 1) 5 (drive 2) (optional)
7	Video Card	—	—	—

* These devices must be present for the APPLE to work correctly All others are optional

TABLE 2

PASCAL — The Outermost Command Level

F (ILE	File manipulation package Allows the user to read copy and delete files, obtain directories of discs etc
E (DIT	Editor Allows the user to edit the current Workfile or any other text file using the interactive Screen Editor
C (OMP	The PASCAL Compiler itself
A (SSEM	The 6502 Assembler
L (INK	Linker Allows the user to link in special routines from libraries other than SYSTEM LIBRARY
R (UN	Run the program currently held in SYSTEM WRK CODE Link in any routines needed from SYSTEM LIBRARY before starting execution
X (ECUTE	Execute a previously compiled file Used when compiled file is held on disc with the suffix CODE Saves having to load it back into the System workfile
D (BUG	This option is not currently implemented

TABLE 3

After everything has been rechecked the APPLE can be powered up and the system fully checked I started off by testing APPLE BASIC to ensure that everything was working correctly The diskette marked BASICS should be inserted into the boot drive (slot 6, Drive 1) before power is turned on since the diskette is automatically booted Have a DOS 3 2 diskette available as this will be needed to get the system started As soon as the APPLE is powered up it loads one or other BASIC into the Language Card and write protects it

The message

(INSERT BASIC DISK AND PRESS RETURN KEY) is then displayed Any diskette which contains DOS 3 2 can then be inserted in place of the BASICS diskette and DOS is loaded by following the instructions displayed The APPLE then works as it always did except that some peripheral cards may have been moved to slots assigned to them by the PASCAL system All this is far more difficult to explain than to do I had BASIC up and running on my system in less than an hour including reading the manual So long as adequate time is available and proper care is taken to ensure that each part is inserted correctly most APPLE owners should have no difficulty in getting the PASCAL system working properly

Using BASIC

Once DOS is loaded almost all programs which would run before should run on the APPLE The only ones I have had difficulty with were some commercial programs from the States which auto load in an effort to stop pirating They rewrite a lot of monitor and BASIC pointers in page zero and this may have caused the problems. The DOS commands INT and FP must be used to transfer between INTEGER and APPLESOFT BASICS as there is no switch on the Language Card. The right BASIC is selected whenever a program is loaded

Filer Commands — available whilst Filer is loaded	
B	Bad-Block scan Test all the blocks on the specified disc to see that all files are recorded consistently
C	Renames a diskette or a diskette file
D	Date — sets a new current date for the system
E	Extended-Directory List Shows the contents of a diskette, together with useful information about the file and the distribution of free space on the diskette
G	Get workfile Specifies given file as the current workfile
K	Krunch diskette volume to collect all free space at end of diskette combined into one area
L	List Directory Shows the content of a diskette
M	Creates a new directory entry on a diskette Produces a dummy file
N	Clears workfile, removing any copies from the boot diskette
P	Prefix all filenames by a new volume name
Q	Quit — go back to principle command level
R	Removes specified file from a diskette s directory
S	Saves the workfile SYSTEM WRK under a given filename
T	Transfers information from one file to another file Can be used to obtain copies of a complete diskette
V	Volumes Lists all the volumes currently online
W	Gives the name and state of the current workfile
X	Examine Attempts to fix bad blocks on a diskette Marks any blocks which cannot be fixed
Z	Zero diskette Erase directory of whole diskette

TABLE 4

Editor commands which move the cursor

Setting the direction for further moves Any of these keys may be used

	Set direction backward
	Set direction forward

Commands which move the cursor *

CONTROL-L	Move cursor up one line
CONTROL-O	Move cursor down one line
	Move cursor right
	Move cursor left
SPACE	Move cursor in set direction
CONTROL-I	Tab to next position
RETURN	Move to next line in set direction
=	Move to start of latest found inserted or deleted text

* These commands can be preceded by a 'repeat factor' This is an integer to say how many times the command is to be repeated

TABLE 5

A welcome feature of the auto-start monitor is that if reset is pressed when in BASIC the system returns to the BASIC command level very much as if (RESET) 3 DOG had been typed before It is now therefore much more difficult to crash a BASIC program and lose it. However since the reset pointer is held in RAM it is possible to overwrite it with errant machine code programs (or ill advised POKEs) in which case the only way to regain control of the APPLE is to turn the power off and restart This is a small price to pay for the improved facility provided Anyway I expect that with PASCAL installed there will be far less need for clever programming at assembler level

A facility has been included for suspending listings by typing CONTROL-S This was sorely missed before particularly when trying to debug INTEGER BASIC programs where no SPEED option was supported Typing CONTROL S restarts the listing

> *'The APPLE originals should then be put away somewhere safely so that if some disaster should occur the system can be regenerated without difficulty '*

Whilst the [illegible] DOS [illegible] once the Language [illegible] I found that DOS 3 [illegible] you do not press [illegible] This is important because a number [illegible] programs will function [illegible] DOS 3 3 is loaded It [illegible] BASICS Diskette [illegible] the boot drive [illegible] the APPLE tries to load BASIC from that diskette and repeats until [illegible] successful If it is allowed to do this [illegible] unnecessary wear to the drive mechanism results It is therefore sensible to have a copy of the BASICS diskette in the boot drive whenever the APPLE is left powered off so that should it be turned on it will load BASIC and wait

Using PASCAL

The method of loading the PASCAL system depends on whether your APPLE has one or two disk drives attached Mine has only one normally so most of my comments refer to the one drive system although I did borrow another drive for a day to make copies of all the diskettes and to try PASCAL [illegible] system. The principal [illegible] when starting [illegible] required [illegible] insert APPLE [illegible] before powering up and [illegible] the P-card into port [illegible] ed you must insert APPLE [illegible] and press reset to start the PASCAL [illegible] two drive system APPLE 1 is placed in drive 1 and APPLE 0 [illegible] and the system start [illegible] both versions behave [illegible] similar [illegible] except that since the complete PASCAL system requires 360 blocks (180K bytes) of disk storage and each diskette will only hold 280 blocks (140K bytes) certain files are not available on APPLE 0 they can of course be copied onto APPLE 1 and APPLE 2 as required The most noticeable omissions are the 6502 assembler and the Linker

Editor Commands	
A (DJUST	Adjusts the indentation of the line on which the cursor is currently positioned Useful for laying out PASCAL programs neatly
C (OPY	Allows the contents of part or all of another file to be inserted at the current cursor position
D (ELETE	Deletes all text moved over by the cursor
F (IND	Looks for 'repeat factor' occurrences of the given string in the set direction S repeats the search from the current cursor position
I (NSERT	Inserts text at the current cursor position
J (UMP	Jumps to the beginning or end of the file, or to a set marker
M (ARGIN	Adjusts text margins
P (AGE	Move up or down the file a 'repeat factor' number of pages
Q (UIT	Exit the Text Editor
R (EPLACE	Substitutes a new string for the given string a 'repeat factor' number of times from the current cursor position Operation is similar to F (IND
S (ET	Allows the user to set various useful parameters
V (ERIFY	Redisplay current page of text with the cursor Centred
X (CHANGE	Replaces the character under the cursor with the character typed
Z (AP	Deletes all text between the current cursor position and the last text found, inserted or deleted

TABLE 6

The PASCAL system is divided into a number of sections each of which is called from the outermost command level The code required for each section is normally held on disk and only loaded when it is requested This allows more facilities to be included than would be possible if the whole system were permanently resident in memory Apart from the compiler itself and the 6502 Assembler a powerful Text

Editor, a Linker to link in user subprogram libraries and a filer to access and manipulate files are provided. Facilities are also required to load and execute compiled programs.

The Filer

The Filer provides facilities to make copy, rename and delete files, as well as copying and maintaining complete diskettes. Provision is made to obtain directories and to copy diskettes as required. A summary of the Filer commands is given in Table 4.

The Pascal system maintains a special workfile on the boot diskette. The workfile always has the same name (SYSTEM WRK). For programs, the workfile often consists of both the text version (SYSTEM WRK TEXT) and the compiled version (SYSTEM WRK CODE). This is useful since both versions can be saved together and can be retrieved when required. The Filer is used to get, save and change the system workfile, when necessary. Only one workfile is allowed at any one time. This is no limitation as the Filer can be used to save the current one before getting the new file. The Editor, Compiler, Assembler and Run command all use the workfile by default.

Compiler Options

All compiler options are placed in the source text in special comments with the form (*$ < option > *) or (*$ < option > < option > *)
e.g. (*$G –) or (*$F – S+ G+*)

Option		Default
C	The following characters are placed in codefile	
G+	Allows GOTO	G–
G–	Forbids GOTO	
I+	Generates I/O checking code	I+
I–	No I/O checking	
I < filename >	Includes named source file in compilation	
L+	Sends compilation listing to SYSTEM LST TEXT	
L–	No comp listing	L–
L < filename >	Sends compilation listing to < filename >	
P	Pages Listing	
Q+	Suppresses Screen messages	
Q–	Screen messages generated on CONSOLE	Q–
R+	Generates range-checking code	
R–	No range checking code	R+
S+	Compiles in swapping mode	
S++	Extreme swapping mode	
S–	Entire compiler in memory	S
U+	Compilers on user lex level	U+
U	Compiles on system lex level	
U < filename >	Specifies the name of library file for finding units	

TABLE 7

The Filer should be used to copy all the system diskettes as soon as possible. The APPLE originals should then be put away somewhere safely so that if some disaster should occur the system can be regenerated without difficulty. The BASICS diskette is also in PASCAL format and several copies should be made to ensure that a copy is always available when required.

UCSD Turtle Graphics Routines

INITTURTLE	Sets high-resolution graphics mode and clears screen. The turtle is set in the centre of the screen
GRAFMODE	Resets graphics mode without clearing screen or re-initializing turtle. Used to swap between text and graphics
TEXTMODE	Returns to text screen
VIEWPORT	Use only part of the screen
PENCOLOR	Sets colour of the line the turtle is Drawing
FILLSCREEN	Fill the screen with the colour specified
MOVE TO	Draws a line to the specified coordinates
TURNTO	Change the direction in which the turtle will move to the given direction
TURN	Turn a given number of degrees
MOVE	Move a given distance in the set direction
TURTLE X)	Returns the current turtle
TURTLE Y)	X and Y coordinates
TURTLEANG	Returns the current angle which the turtle is facing
SCREEN BIT	Tells you whether a given location on the screen is block or not
DRAWBLOCK	Allows you to draw complex patterns on the screen
WCHAR	Writes a character at the current turtle position
WSTRING	Prints a string from the current turtle position
CHARTYPE	Defines the current mode for typing characters on the high-resolution screen

TABLE 8

The Text Editor

The text editor is screen based and has been specially designed for use with video terminals. When the Editor is called by typing E at the principal command level, a prompt line is displayed on the top line of the terminal and the first section of the file is shown on the rest of the screen. This is the editing window. The Editor's text window is eighty characters wide. Unfortunately the APPLE's TV display is only forty characters wide. This means that only the first forty characters of each line are normally displayed on the screen. The right hand half of the text window is displayed by typing CONTROL A. Typing CONTROL-A again returns the display to the left hand half of the text window. The cursor can be moved to anywhere in the current text window using the cursor commands listed in Table 5.

The main editor commands are listed in Table 6. They allow the insertion, changing and deletion of text at the current cursor position, and moving the current text window either forward or backward through the file.

On quitting the Editor the current workfile can be updated, the new text can be saved in a named file, the Editor can be re-entered should this be necessary, or you can return to the main command level without saving the new file.

The Compiler

When the C option is chosen the compiler is loaded. If SYSTEM WRK TEXT exists the compiler attempts to compile it and placed the compiled code in SYSTEM WRK CODE. If the system workfile does not exist the compiler askes the names of both the text file and the code file.

The progress of the compilation can be followed by the screen display, which indicates when each procedure or section is processed. Each line processed is indicated by a dot on the screen. Various options (see Table 7) control the operation of the compiler. If no compilation errors are found a codefile is produced for later execution, but if a compilation error is found the action depends on which options are currently selected. If L+ is in effect the error is flagged in the listing and compilation continues. Otherwise the user is given the option of continuing the compilation, finishing immediately, or going straight to the Editor with the cursor placed over the point where the error was detected.

APPLE have provided a series of procedures and functions in the library file SYSTEM LIBRARY which can be automatically included in any program. These fall into three main areas, that is, string handling, graphics and routines peculiar to the APPLE. UCSD have developed the "turtle graphics" system developed by Seymour Papert at MIT (Mass). Commands follow those of a "turtle" dragging a pencil across the screen. Complete patterns and plots can be generated very easily by using the various 'Turtle' commands. The Turtle starts off in the centre of the screen facing right, and can move forward or turn as required. In theory the APPLE can produce plots in up to twelve colours, but with the vagaries of PAL cards and British colour televisions very few of these are discernible on most systems.

The Assembler and Linker

The Assembler is a relocatable macro assembler which has a number of facilities which are specifically designed to ease the writing of routines to be linked in to PASCAL programs. At first sight it appears to be a conventional macro assembler which uses almost standard 6502 mnemonics but there are some interesting extra facilities. Conditional Assembly is allowed which can be useful in certain circumstances. The pseudo operations PROC and FUNC identify procedures and functions respectively to PASCAL so that they can be called conventionally from a PASCAL program.

Constants and variables globally declared in the PASCAL program can be assess ed with the CONST and PUBLIC pseudo directives whilst variables can be stored in the global area without the knowledge of the PASCAL program by using the PRIVATE directive thus allowing the sharing of information between the PASCAL program and assembler routines Parameters can also be passed in the same way as any other procedure or function

Since the Assembler generates relocatable code no addressing information is available until it is linked into the PASCAL program This means that the Assembler unfortunately cannot usefully be used to generate code for other 6502 microcomputers such as the KIM unless you are prepared to generate the address yourself.

The Linker is used to link preassembled or pre-compiled PASCAL routines which are not stored in SYSTEM LIBRARY into a PASCAL program before it can be executed It allows libraries of useful routines to be created and linked into programs as needed It sorts out linkages and addressing information as required and ensures that a complete codefile is generated ready for execution

The R and X commands are provided for the execution of user programs The R(UN Command runs the current file SYSTEM WRK CODE after linking any routines required from SYSTEM LIBRARY The X(ECUTE command is similar except that it takes the code from a named file thus eliminating the necessity to enter the Filer to get the code into the current workfile

Utility and Demonstration Programs

APPLE3 contains a number of useful programs including a number of interesting graphics demonstrations The most useful utilities are the diskette formatter Library maintenance and system maintenance programs The diskette formatter must be run whenever new diskettes are introduced to the system and performs a similar function to the INIT command under DOS The Library maintenance program allows the insertion and deletion of units and routines from the system and user libraries A library print routine is also provided The system maintenance program allows the various control characters and other properties of the system console used by the Editor to be changed so that any suitable terminal can be used It is also necessary to write a PASCAL routine GOTOXY which moves the cursor to the required position on your terminal and binds it into the system with the utility program provided before your terminal will work Examples are provided for the Hazeltine 1500 and Soroc IQ120 terminals

Package

A PASCAL cross reference program is also included which should prove very useful No pretty-printer program is provided to clean up poorly laid out programs but this will surely be made available soon from one of the software houses

Conclusions

APPLE have produced yet another very interesting package It is attractively priced at £296 + VAT and is available from all APPLE dealers It provides a useful upgrade for the APPLE owner who is finding the limitations of BASIC There is ample opportunity for the independent software suppliers to provide libraries of badly needed routines to help him develop more complicated programs It is also possible to develop a true turnkey system which handles all its own exception conditions something which is impossible with a BASIC interpreter

'The effort required to build up subprogram libraries is well worthwhile as many simple tasks are required in large numbers of programs'

By maintaining compatibility with the BASIC/DOS system, all user programs remain fully usable until superseded by replacement PASCAL programs If you do not have a copy of DOS 3 2 yet you are strongly advised to obtain one before installing PASCAL since the behaviour of DOS 3 1 when RESET is pressed is annoying — to say the least

The [illegible] programs The [illegible] necessary

Up to now PASCAL has found its main uses in the education of Computer Science students It encourages them to write clear concise properly structured programs which their teachers and lecturers can read and understand Industrial and business APPLE users can now share in the delights of a structured programming language with all the facilities they had in BASIC and more From reports of early sales both in this country and in America there will soon be a large and knowledgeable APPLE PASCAL user community which will encourage magazine articles and software products to the benefit of all

It is unlikely that most users will need to use the Assembler but it is a very useful facility to have if required Most systems—type programs are better written in PASCAL except when intimate knowledge of the APPLE or the 6502 are required Very simple driver routines should be provided for input/output drivers and these linked into PASCAL units to provide a proper user library which is available to any program

After learning the absolute basics I found the system easy to use and was soon trying out my own programs The heavy use of control characters particularly in the Editor makes the provision of a *[illegible] sheet* an absolute necessity APPLE unfortunately do not provide this but it is simple to construct yourself as you use the system The BASIC programmer will find the range of facilities available to him bewildering at first but will soon find their usefulness When running PASCAL the APPLE behaves far more like a minicomputer than the current generation of microcomputers with the consequent need for considerably increased disk storage Apart from the 11 Mbyte fixed disk currently available from Keen Computers in this country APPLE themselves are working on higher capacity disk drives that when available should alleviate this problem Whilst the system will work well with one disk drive two are required to give full effect to all the facilities provided

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THE GREAT STRUCTURE DEBATE

PASCAL v BASIC

Does structuring mean loss of flexibility or greater freedom to program precisely?

The growing availability of the PASCAL programming language on a number of commercially available microcomputer systems has extended the ground over which the debate about structured programming has ranged to that of the small computer. Although the debate has encompassed both the methodology of the structured approach and the choice of programming language used, it is over the language that the argument has been at its keenest. The choice of high level language for the majority of microprocessor users in the next few years will be deceptively simple, the only two serious contenders being PASCAL and BASIC. My purpose in writing this article is to examine both these languages with regard to their suitability for structured programming. I shall only deal with some of the more obvious advantages and disadvantages of both languages and examine some of the proven advantages of the structured approach, namely, readability, ease of maintenance and ease of program debugging. Notwithstanding this brief approach I hope that the description will be enough to illustrate why PASCAL has become a serious contender for the programming crown previously held by BASIC.

Identifiers

In PASCAL a user is given a great deal of flexibility with regard to the construction of identifiers, while in BASIC the user is forced to keep to single letter identifiers or identifiers constructed from a letter followed by a digit. Notwithstanding the structured approach to programming, it seems only common sense that identifiers should describe the objects that they stand for. Thus if you have written a program which keeps control of your finances a language like PASCAL that allows you to write *(See Fig 1)*

```
IF CURRACCBALANCE < OVERDRAFTLIMIT THEN DEBT  —  CURRACCBALANCE
```

Fig 1

It offers more in terms of readability and ease of program maintenance than BASIC which would only allow you to write

```
10 IF C> - 0 THEN 30
20 LET D = C
30
```

Though the advantage that PASCAL has over BASIC with regard to identifiers is only marginal with small programs, the benefits become marked when considering large programs which may contain a large number of identifiers, some of which are similar e.g. currentbalance, currentoverdraft and currentaccountnumber.

Control structures

One of the main tenets of structured programming is that programs should only be constructed using the two control structures of selection and iteration. Selection is usually implemented in a higher level language by means of some form of IF and/or CASE statement. The common example of a series of statements which are to be executed if a condition is true is implemented in BASIC by means of a GOTO statement and a primitive IF statement.

```
20 IF   V > 3 THEN 50
30 LET A - 3
40 LET P - 10
50
```

If in addition a series of statements were to be executed if the condition is false, then the complication is handled by a further GOTO statement.

```
20 IF   V < = 3 THEN 80
    30 LET A - 3
    40 LET P - 10
    50 GOTO 80
    80 LET X    Z
    80
```

A more sensible approach is taken by PASCAL, where statements to be executed are bracketed by BEGIN and END.

```
IF VELOCITY > 3 THEN
   BEGIN
   ANGLE   = 3 .
   PITCH  = 10
   END
ELSE
    BEGIN
    XCOORDINATE  = ZCOORDINATE
    WRITE ('DATA OUT OF RANGE)
    END
```

If you examine the example that I have given, you may be forgiven for thinking that the advantage that PASCAL has over BASIC is slight. In a large program, however, where selections are nested to a fair depth, the BASIC approach can be very confusing, especially during the time consuming debugging stage where a programmer is continually scanning his source language listing. The other selection facility which is available in some high level languages is the CASE statement, where the execution of a statement or series of statements depends on the value of an expression. A PASCAL example is

```
CASE  ACCOUNTTYPE  OF

  1  WRITELN ('CURRENT ACCOUNT')
  2  WRITELN ('DEPOSIT ACCOUNT')
  3  WRITELN ('SPECIAL ACCOUNT')

END
```

Here the statement WRITELN ('CURRENT ACCOUNT') is executed if ACCOUNTTYPE has the value 1 while the statement WRITELN ('DEPOSIT ACCOUNT') is executed if ACCOUNTTYPE has the value 2 etc. This generalisation of the IF statement has no equivalent in BASIC and has to be simulated, albeit rather awkwardly, using IF and GOTO statements. Repetition is achieved in high level languages by means of some form of FOR statement and some variant of WHILE statement. The FOR statement in BASIC is more flexible than the corresponding statement in PASCAL which allows only a step size of one or minus one, thus in BASIC

```
10 FOR I = 1 TO 21 STEP 2
20 LET A(I) = I
30 NEXT I
```

would execute statement 20 for values of I equal to 1, 3, 5, 7 ... 21. The other statement often used to achieve repetition is the WHILE statement; this statement, which has given rise to more heated arguments than any other programming language statement, can be described by the words 'while something is true keep executing some statement(s)'. Its logic occurs in virtually every program that has been written and is probably the most difficult statement to learn in PASCAL and other structured languages, especially for programmers who change from an unstructured language such as FORTRAN. It is, however, a very powerful tool. In order to illustrate its use I shall take the example of a program that reads in a set of numbers which are terminated by a negative number and prints out their sum. In PASCAL this would be programmed as

```
SUM := 0; READ(NUMBER);
WHILE NUMBER ⩾ 0 DO
  BEGIN
  SUM := SUM + NUMBER;
  READ(NUMBER)
  END;
WRITE ('THE SUM OF THE NUMBERS = ', SUM)
```

while in BASIC, which possesses no WHILE statement, it would be programmed as

```
10 LET S = 0
20 INPUT N
30 IF N < 0 THEN 60
40 LET S = S + N
50 GOTO 20
60 PRINT "THE SUM OF THE NUMBERS IS"; S
```

Comparison

In the two examples there doesn't seem much of a difference. It does however become noticeable where large programs are written. In these large programs the looping may become nested and the loop distances quite long. A programmer trying to debug a program in a language like BASIC, where the control structures are quite poor and have to be simulated using GOTO statements, can often be seen switching from page to page and back again rapidly as he reads his source listing. A programmer who uses a structured language should be able to read his program as he would a book, in a serial way. Here lies the roots of one of the great controversies of programming, the goto controversy. One of the aims of the structured approach to programming is the virtual elimination of the GOTO statement; there will be instances however where the use of the GOTO statement cannot be avoided, an emergency exit from a program would be one example, but the undisciplined use of the GOTO can lead to a great deal of trouble when a program is debugged or modified. As an example, examine the BASIC fragment

> *'Even after long periods away from BASIC I am able to program from cold very easily.'*

```
30 GOTO 50

50 LET A[I+1] = A[I]✱A[I-1]

90 GOTO 50

110 GOTO 50
```

Assume that a subscript overflow has occurred on line 50; the problem in debugging this program fragment is the possibility that control has been passed to this line from one of three possible lines. In a well structured program the question would be resolved fairly easily as the program flow would be strictly from the top down. BASIC, with its primitive control structures and its line number oriented form, encourages the programmer to be generous with the use of GOTO statements, while experience has shown that it is difficult to write anything but structured programs in PASCAL.

Subroutines

One of the aims of the structured approach to programming is to be able to analyse a large problem, split it up into smaller sub-problems, split these sub-problems up again etc. Eventually the programmer will be left with a number of small problems which are amenable to a programming solution. More often than not the problems with which the programmer is left are expressed as subroutines; it is clear that a language that possesses a flexible subroutine facility is going to offer more to the programmer adopting the structured approach. Examining PASCAL and BASIC one is struck by the difference in approach, BASIC has no parameter passing mechanism and implements a call to a subroutine by means of GOSUB followed by a line number. PASCAL allows the programmer to name the subroutine and to include parameters. This has a number of advantages over the BASIC approach; if we examine the PASCAL call

```
FINDMAXIMUM (TABLE1, MAXVALUE)
```

we can see that it provides more information than the BASIC

```
GOSUB 500
```

The least we can say about the call on FINDMAXIMUM is that a maximum is to be found, that possibly a table called TABLE1 is to be searched to find that maximum, and that the maximum is to be placed in MAXVALUE. In order to get the same information from the BASIC call the programmer would have to work his way through the code for the subroutine at line 500.

There are other comparisons that one can make between the languages, the richness of PASCAL's data types as compared with the limited facilities of BASIC would be one, which, taken with the previous comparisons that I have made, seem to suggest that the future for BASIC is not very hopeful. There are however a number of factors which will ensure that it will at least keep parity with its only real challenger on the microprocessor, PASCAL. Firstly, PASCAL can only be used on large micro systems and is still rather expensive to purchase. Secondly, BASIC has the supreme advantage over PASCAL that it is easy to learn and use; a novice can usually write satisfying programs within hours of being exposed to the language.

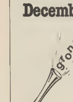
My own experience with PASCAL is that after a gap of a number of months during which I hadn't used the language I needed to use a reference manual for the first few programming sessions, while I have found that even after long periods away from BASIC I am able to program from cold very easily. A third reason is microprocessor application programs tend to be quite small; the advantages of structured programming are only really noticeable when constructing fairly complex programs. One development that may keep BASIC to the fore is the provision of structured forms of the language on microprocessors.

Structured dialects of BASIC are readily available on a large number of mainframe and mini computers and it seems only a matter of time before these dialects, which attempt to remedy the deficiencies in BASIC that I have outlined, are widely available on microcomputer systems. Whatever does happen, it is certain that the next few years will see the struggle between PASCAL and BASIC intensify and that the developments that arise from the interplay between these languages can bring nothing but benefit to the microcomputer user.

Dr Darrel Ince is at the Faculty of Mathematics, The Open University, Milton Keynes.

THE BLUNDER BUS

December's Wonder Blunder



"Information must be structured" or it [illegible] chaos. A perfect illustration of this is on page [illegible] of the December issue, where the second and third columns contained the full copy — mixed up. Entropy definitely won that time. Our apologies to the author, Richard Hooper of Mills and Allen Communications Ltd. We here reprint the contents of second and third columns (and a bit of the first column) on page 83.

In the short term there is one major constraint on the development of Prestel in the home market: cost. Bryan Quilter, managing director of Granada TV Rental Ltd, gave the following cost predictions at a recent Mills & Allen seminar. The average business user would spend £750 a year on Prestel: the figure includes rental of a 16" colour set, telephone and Prestel charges for use. The average home user would spend £440 a year (this includes rental of a 22" colour set). Whereas for the business user the set rental would be £300 out of £750, for the home user the set rental would be £400 out of a total of £440. As a result, in Quilter's view, the home market was further away. He did of course stress that the home user spending £440 gets broadcasting teletext and Prestel, not just Prestel. ITT Consumer Products in September 1979 forecast a market for domestic viewdata sets of 100 000 in 1982 growing to [illegible] in 1985. In 1985 the penetration of viewdata would be 10% of homes. As the domestic market expands, there are likely to be other viewdata systems for public access — the Post Office is not defending any monopoly here. Indeed, the Granada TV Prestel sets have four buttons for automatic dialling, only one of which (Prestel) is currently operative. As with TV broadcasting, new channels are likely to emerge at competitive prices.

In the United States, the union of personal computers and viewdata type systems has also begun. Amid much publicity *The Source* opened in June 1979 from the Telecomputing Corporation of America. The user requires a personal computer with telephone dial up facilities. The service is only open out-of office hours. The price is low: $2.75 per hour of use. The user can get UPI news services, games, programs in Cobol, Basic and Fortran, plus an electronic mail facility.

Communications capability is in my view essential to the development of personal computers as a mass domestic product. The great break through in Prestel is the arrival of the integral modem set. Down the paired wires of the telephone system the empty machine will be filled and refilled. For the computer buff, programs can be quickly distributed. For the general home user, information and entertainment, plus contact with friends and relatives. Roll on 1985.

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What is a modem?

The information exchanged by computers and other data processing equipment is generally in a binary form that consists of a simple voltage on or off pattern. However, the analog voice telephone system that presently represents the most readily accessible, wide-spread communications facility was not originally intended to carry such patterns. To make possible the transmission of data over voice frequency channels, the binary data processing language must be translated into the analog voice communication language.

A modem is a device that provides this translation. It accepts digital data from a computer and produces a modulated continuous [illegible] signal that is suitable for transmission [illegible] channel facility. It also accepts analog signals from other modems and returns them to a digital form.

Historically, manufacturers have sought to increase the data capacity and extend the operating range of modems. This has resulted in the proliferation of equipment that is well suited to high speed, long haul applications. In many cases, however, it has also meant that short haul networks have had to under-utilize modem capabilities.

For example, a university may have a number of high speed [illegible] remote job entry terminals located in offices around its campus. Interconnection of these terminals by expensive high speed modems that are also usable on long haul networks would not be cost effective because of the limited distances involved. Similarly, an industrial complex having a number of separate buildings could take advantage of a central computing facility through modem based data links. Again, however, this represents a wasteful approach because of the relatively short distances between sites."

(Extracted from [illegible])

What is Optical Mark Reading?

OMR is a data input technique which transfers data directly from a source document onto a computer file. It requires no manual intervention or data preparation procedure such as key punching or data input. OMR therefore not only eliminates a common source of error, but also the costly procedure of data preparation and verification.

An OMR machine detects and interprets the presence or absence of marks. It converts the marks (either handwritten or punched holes) into coded electrical signals which are computer compatible and can immediately be stored in a computer memory or other storage device.

OMR is an extremely simple method of data collection and can be used in situations where other collection methods would produce unreliable or inaccurate data. OMR operates using preprinted forms which are completed by simply making a pencil (or felt pen) mark against the selected response. With a well designed OMR form a large volume of data can be collected very quickly and easily and can be used in a number of situations - the office, warehouse, retail store, on a building site or in an examination room.

Simplicity coupled with access to a remotely sited OMR machine means that the data can be read and interpreted extremely quickly, thereby eliminating the time lags usually inherent in such operations. Such a system offers an unbeatable combination of advantages - high quality, low unit cost and vastly increased throughput. *Courtesy of Data & Research Services Ltd of Milton Keynes.*

Newsflash

Geest Computer Services Ltd (GCS) signs a major order for computer equipment with Texas Instruments Bedford UK. The equipment will be delivered during 1980 and will earn over £1.0 million for GCS. At the signing ceremony (left to right) Mr John van Geest, President of the Geest Organisation, Mr David Monk, Marketing Manager, Texas Instruments UK, Mr Graham Gough, Managing Director, Geest Minicomputer Systems Ltd, and Mr Philip Wainwright, Managing Director, Geest Computer Services.

In a major switch of policy **ICL** has linked up with **Systemsolve** the Systems house to cooperate in the marketing of ICL products. Although Systemsolve will not have a monopoly of this type of marketing link-up with ICL, it has shown great enterprise. Systemsolve is itself a medium base company and its linking up with a giant like ICL shows that at last ICL is showing marketing verve. ICL will allow Systemsolve to buy its computers (right up to the 2904 range) at dealer (OEM) prices to sell to customers which Systemsolve has tracked down for itself. Software can also be included in the deal. With this move ICL has at once increased its sales staff without taking on additional personnel.

John Sta[illegible] [illegible] (Computer [illegible])

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[illegible]

The Trouble with Teletext

On not quite seeing the facts and not quite consulting the oracle

The idea of transmitting a hundred or more pages of written or diagrammatic information by television is [illegible] thought! And when an extremely clever system has been developed to incorporate these pages within the standard TV signal bandwidth enabling them to be available to every TV viewer in the country it would seem to be just a matter of time before Teletext becomes as popular as daily papers. Once equipped with the modestly priced decoder option the generation of TVs just around the corner would allow us to check the news headlines at breakfast time have a quick look at local road conditions or see what's happening on the motorways we will use later in the day. Teletext could also give us the weather stock market figures food prices and even the state of the top twenty pop record charts

After having had teletext domestically installed for two years now I cannot deny that it does just that. What bothers me a bit is the way it does it

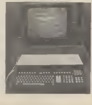
Murphy's Law describing the Behaviour of Inanimate Objects could be extended to incorporate one of the chief characteristics of the present teletext system. This would make the statement that

The number of the next available teletext page will be the required page number plus one

Since the teletext pages are currently transmitted in numerical order this means that I have to wait the full 30 seconds or so before the page I have dialled up appears on the screen

Another curious characteristic of teletext is the high forgettability factor of the full index. It is easy to make a mental note of three or four page numbers (they are all three-digit numbers by the way) but having waited for and eventually assimilated the contents of the first chosen page the remaining numbers seem to fade from the mind (They do from mine anyway) One must then resort back to the index pages again assuming you haven't forgotten *their* numbers. If the latter happens your only hope is to call up page 100 which contains a brief guide to all the major sections of teletext

Once upon a time I had managed to commit to memory the numbers of about four or five of the pages I regularly look at such as the news headlines the weather map and the cricket scores but some months ago many of these were permanently changed and I haven't bothered to relearn the new numbers. In any case, the pages on Ceefax 1 and Ceefax 2 (BBC1 and BBC2 channels) and Oracle (ITV) have different numbers for the same subjects. I suppose I could write the numbers down when I'm looking at the full index but here I am sitting in the armchair holding the key pad in my left hand and poking at it with my other hand, and it does seem a shame to have to resort to pencil and paper to get the best out of this miracle of technology



To be quite serious two negative factors stand out in the present organisation of the UK teletext system. First the almost intolerable delay in viewing a chosen set of five or six pages about the number I normally want to look at and second the cumbersome three digit page numbering system which necessitates frequent reference to a low repetition rate main index

Few people will want to read the entire contents of each teletext magazine. For one thing it would take more than 45 minutes to put up all 100 pages sequentially and proportionately more for the few hundreds of pages on ITV's ORACLE so some selectivity must be exercised by the user

When I pick up my usual daily paper, I don't need an index. I know roughly where everything's going to be. The first thing I do is look at the front-page headlines flip quickly through the remaining pages and make a mental note of what's going to interest me with due regard to the time I have available for reading

Is there not the possibility of rearranging teletext to give the same rapid grasp of the contents? Provided the memory capacity of the decoder can be improved (and from what I read, that should no longer be an obstacle) I think there may be a way of achieving this

At the present time only one page of teletext is stored in the memory at the decoder. If this could be increased to 10 pages the way would be open to reorganising the subjects into 10 main headings. Imagine the pages being laid out in a square 10 rows by 10. The pages down

Continued on page 80

Marlene Brown

Is small computer ... within the reach of every business ... but ... the greatest challenge facing businesses ... How will the business user respond and adapt to computer based information processing systems?

To get some kind of answer to the question Marlene Brown talked to first time users and what follows is a compilation of how they adapt the computer to their business needs. This Two Users is about medium businesses. In future we shall have one medium business and one small business.

Executive using one of the line enquiry terminals at Charles Taylor and Co

THE SMALL SYSTEMS MARKET HOTS UP

Every month in Computer Age Two Applications stories in the Two-Users pages

ONE

The management of *Charles Taylor & Co* had the foresight in early 19[illegible] to see that a computer-based system would control not only the quantity of information generated but its quality, providing larger storage capacity and on line access to their four main departments – claims handling, underwriting, financial and administrative

Appointed London Agents for their head office in Bermuda the City firm manages five different mutual assurance associations in the marine industry The main association is the Protection & Indemnity Standard Club and its members are shipowners who join together to pay their own and each other's liability claims There are 639 members from 25 countries and their total tonnage entered is 26,660,157 Established 100 years ago it is called a Club because its purpose is not one of gain but of mutual help

'Many of our members do have their own insurance companies but they join a mutual club like ours to handle their third party liability risks where we can provide an international claims handling service through a well based network of correspondents and representatives in every port around the world says Bruce Sturgess the Financial Partner

There is no limit to the cover provided by the Club It is an unlimited one arranged through re-insurances in Lloyds which takes the cover up to $300 million for any one incident Over that level the risk falls back on the Club

The Management set its objectives in early 76 and called in their consultants *Spicer & Pegler* who also act as their auditors to write a detailed specification for tender "Going from the quill pen to the computer was a very big step, says Sturgess but it was money well spent to have that in-depth analysis of our particular requirements He adds I think it is right for auditors to act as consultants, they have the client list and have built up a good reputation as an honest firm of accountants"

> *'If we were dealing direct with any supplier, they could have taken us for anything, because we were not qualified to criticise '*

In May 1977 the company installed a Systime 5000 PDP 11/34 with 192K bytes of memory expandable up to 256K three 40 Mbyte disk drives with a total capacity disk storage for 120 Mbytes one Control Data 400 lpm printer a Decwriter for use as a control terminal, and eight Systime visual display units Three VDUs are solely for input of data and the remaining five are strategically placed around the office so that all executives have available the same up to date information

Initial investment in software was around £90 000 hardware £80 000, with consultancy and programmer fees totalling £14 000 Although Spicer & Pegler's study report provided initial requirements additional effort had to be expended by *Applied System Techniques* (AST) to re write the requirements to provide functional specifications to fit the needs of the total development effort Systime supplied a special indexing program and the software developed by AST is a complex set of tailored programs to handle a number of tasks

One would always like to find a way of doing without the consultant s fee says Bruce Sturgess "Spicer & Pegler certainly knew about the various options available to us and I think you might be able to do it yourself if you could find the right software house who had such integrity and the ability to think of your problems rather than their financial targets He adds We definitely felt we needed to have a buffer between Systime and ourselves and if we were dealing direct with any supplier they could have taken us for anything because we were not qualified to criticise

The system implemented in simple manageable structures was phased in during September 77 starting with the main application – the claims processing suite of programs The computer stores a record of claims payments for eight years

Two Users

Each year claims could be at least 5 000. Claims are analysed by the Rule number with breaks on geographical location, currency, ship and member, requiring a larger storage facility. Another feature is instant access to an update file and the VDU terminals placed around the office will speed up and refine the flow of information so that any executive can immediately access a member's file. He would know instantly that that is the current state of the record. The computer will also process details of payments made to beneficiaries and generate debit notes for member premiums.

Each member pays an advance call at the beginning of each policy year and the total of all the advance calls forms a fund from which the Club pays its claims. Approximately two years after the expiry of the policy year the liabilities for that year are reviewed and if necessary a supplementary call is levied to balance the income and expenditure so as to make neither a profit nor a loss.

"On mid day February 20th, our year end, we just press a button and off comes anything up to 700 call notes," says Gordon Groves, Systems Manager.

The system will also produce supplementary notes usually half way through the financial year. On their previous visible record computers processing took days rather than a few hours, but, "Now we can get debits out to our members and hopefully get their premiums back a lot quicker," says Groves. The system has greatly improved credit control with speed and significant check out time, enabling the user to process payments and chase ship owners slow to pay calls.

The main production of call notes occurs once or twice a year. But for new members joining or existing members with new vessels the system will again process a "one off" call note.

In November each year, the company produce renewal statistics to enable the underwriting department to set renewal rates. The computer produces an experience record for each member tracing out the member's history over the previous seven years, detailing premiums received for the member, claims actually paid out and evaluating claims of future liability on the Club. From this information, the Club can estimate each member's loss ratio and calculate certain overheads to give the final renewal rate for the year.

"We have been processing this over the last two weeks and with our old visible record computer system it took anything up to four months to achieve, but now we are hoping to produce these records together with the necessary returns that go with it all within a week," says Gordon Groves.

Systime's indexing program called Access D allows the user to hold multiple indices to a given file. For example it enables the operator to access the claims file in many different ways, giving a variety of six indices to that one file. Other programming concepts incorporate accounting functions.

A memory typewriter produces certificates of entry for every vessel listing each kind of risk covered. Over the next two months the company will introduce the Word-Eleven word processing package marketed by Jensen of Bristol to produce certificates of entry and agendas with minutes for board meetings.

Staff see the computer as a new challenge with immense benefits, well worth the time and effort. Added advantages are more timely accounting statements and staff reduction through natural wastage.

"With space in the City costing £20 per sq ft, the storage facilities in a computer will over the years save us quite a lot of space and expense," says Bruce Sturgess.

"We are getting very good service from our contractors AST," he adds. "And it is a very arrogant approach if you think you can spend time looking around computer showrooms and deciding which computer will do the job best. In this wide and ever-changing market only if you are involved all the time can you decide what best product is available for your needs."

To this Gordon Groves adds: "To help the businessman make the right decision, I think he needs a good software house or consultancy so long as that software house does not deal with just one manufacturer." "When the software people specialise on a particular manufacturer's equipment, if they have never used any other, how can they really advise on the design and development of an efficient and effective system?" asks Groves.

The write-off in the company's books is over five years, and they are just half way through that period now. "It would be imprudent if we wrote it off over longer than five years and I still have an open mind as to whether or not we shall have to develop a new system," says Bruce Sturgess. "It is helping us provide a better service, a more immediate response to statistical requirements and it has made us much more efficient as a company. I think we can say it has paid for itself in a year."

TWO

A real time on-line computer processing system tailored to user needs and designed to handle a large volume of security data has brought big benefits to the customers of *Datakeep – Hays Business Services*, the London based security storage company. A bespoke package written and designed by Zeus Hermes uses business Basic on Data General's Nova 3/12 to give a fast method of implementation claimed to be far more efficient on the Nova than writing programs in Cobol. By simply telling the computer what the business wants, the system provides additional flexibility coupled with the ability to respond to changed requirements as the business expands.

Hays library stores some 75 000 commercial tapes with 100 disks and moves over 250 000 tapes in and out of the warehouse each year on a daily, weekly or monthly basis. Stored master tapes or back-up tapes are delivered or collected to or from customers each day. The system provides the capability to generate and update inventories together with a statement of cost at the end of each month. The inventory gives details of the maximum number of tapes in store and in transit with a final summary of the cost incurred against each client serial number. Security control for the movement of tapes in and out of the warehouse ensures that each customer record bears a three digit code and the computer produces a daily list and a monthly report for accounting purposes.

'We just press Request and the answer is there in four minutes.'

The system also controls the storage of 200 000 seismic exploration records for over 25 oil companies and provides inventory control for core samples for oil well data to enable the customer to examine stored information at Hays' lab. The present key to disk data entry provides greater flexibility with easy access to information in store and a set of characteristics keyed into the machine enables the system to search through customer files, pick up anything that matches those characters and display it on the screen, thus allowing the user to guage exactly what data is in store for that specific customer to match in with a particular spec. The largest customer file holds 120 000 records of seismic exploration data.

Other large customers are advertising agencies for the storage of 13 000 films, each coded to match a film. Input by code produces a listing by agency, client, product and film title. At the end of each quarter the system will calculate the cost itemised by every individual pack in store and the printout displays a breakdown of cost for each individual client

Another application is the bulk storage of 50 000 sq ft of computer stationery for banking and insurance customers All customers have a three-digit code which enables the system to produce each month a listing of stationery despatched to the customer and received from the supplier together with a stock reconciliation 'On the manual system it took two or three days checking and re checking, but now we just press *Request* and the answer is there in four minutes It also cuts down on errors and gives far greater accuracy than ever before' says Systems Manager Bill Potts

Currently Hays are expanding the system to incorporate additional services for an accounting and administrative system to increase efficiency and remove drudgery from work

All the hardware is Data General with 32K words memory floppy disk drive 10 Mbyte (5 fixed and 5 exchangeable) cartridge disks, two VDUs and a 180 CPS printer Initial investment in software was £16 000 and hardware £24 000

Extra large storage facilities with larger disk drives was a major consideration when purchasing the hardware and with such large-scale storage of data the user needs to know far more about every tape Hays has been growing fast both through volume growth and through acquisition of other companies of a similar nature and the service today is not far off double that provided 18 months ago Extra hardware is now considered which will alter quite dramatically the present configuration Their ultimate objective is further expansion to cover a wide range of complimentary services to other businesses

Zeus Hermes Sales Director John Oke, says The installation is unique in that it was a first time for us on Data General equipment One of the problems faced by

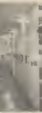
Two Users

any turnkey supplier when they start using a new piece of equipment for the first time is finding out how it will work and behave under any given set of circumstances Zeus Hermes claim that because they are more technically orientated than most other software houses they were able with little difficulty to handle the DG equipment develop the software and complete the assignment well on time

The Data General Nova performed very well and with Zeus we said exactly the way we wanted it done and it was done just as requested " says Simon Mounsey Hays Operations Director

First installed and tested at Zeus Hermes offices the equipment and programs were then transferred to Hays Program development and installation of the system required approximately six months and for a short while ran parallel with the IBM bureau system A time critical period towards the end of the bureau contract brought Hays costs up to £3 000 a month so naturally they were impatient to run the first application on-line as quickly as possible At the time there were 19 000 commercial tapes and 200 000 seismic exploration records moving in and out of the warehouse on a 24-hr service At cut off point, all data had to be transferred at top speed to put the commercial tape application on line

The cut off date with the bureau was Friday night, Zeus transferred the tape to disk which then went to Hays who in turn transferred it from the IBM format to Nova in time for the following Monday when they were ready to start parallel running This was probably the hardest test the equipment will ever get because we put a lot of data on it in a very short space of time and did some parallel run-



[illegible] at Hays Bus[illegible] are [illegible]

ning for two weeks to compare results says Bill Potts The advantage of development testing at Zeus Hermes site was that most bugs were sorted out so there was not much debugging to do he said

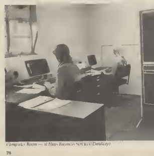
By simply pressing a button details of a particular tape are instantly displayed on screen and this has cut down response time and improved accuracy for customer service The customer is quite impressed if he telephones us and we can supply details of tape with an average delivery time of 30 minutes in the Greater London area which is well above our normal guarantee of two hours says Potts

We have tried to keep everything as non-technical as possible so that we are not too dependent on the hardware and software suppliers says Mounsey To eliminate the expense of employing analysts and programmers many users do have a field engineering agreement with the supplier for the hardware and a service agreement with the software house

The computer is a powerful tool to help us with our data storage business quickly and professionally to give an ongoing service to our customers It has to be easy to operate so that we can have an average VDU operator on her own and we do not want to get into the problem of employing programmers we don't really need he explains

We are taking on more customers now which we could never have done under the old system and we are doing this without increasing our staff says Simon Mounsey The computer is an office machine rather than something special it is a tool to be used by everybody so it must be simple to operate by people with limited technical training

The system a real asset to the company has paid for itself in the past year Hays estimate their bureau costs would now be £45 000 a year with less data on it and less flexibility They hope to run the system for the next seven years and develop certain tailored applications to keep up with further expansion



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from p75

the left hand side would represent the main subjects No doubt considerable thought would need to be given to the choice of main subjects but they could include

Teletext

1 News (National)
2 News (International)
3 News (Local)
4 Weather and Travel
5) Domestic Pages
6) Entertainments
7) Sport
8) Unclassified
9) Advertisements (Sales)
10) Advertisements (Employment)

Having a ten-page memory means that any one of the 10 can be displayed instantly and there need be no page number involved the section title can be engraved on the relevant button on the key pad To read across the sections from left to right the memory is switched into the horizontal mode storing the 10 pages coming under the same subject heading, and providing the same instant access by means of another set of page buttons on the key pad

This square teletext concept removes what I consider to be the two main problems at present the long access time and the need for an index Unfortunately my formative years in electronics took me into the realms of what is now disparagingly called the analogue period when logic meant something quite different so I don't know if the idea will work within the current teletext specification Perhaps one of my better informed contemporaries could tell me

This system the TECs from Technalogics is microprocessor based and is a Teletext/Viewdata decoder as well as having powerful local computing possibilities And now look out for computers cunningly disguised as TV sets!

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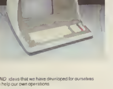

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